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(THIRD SERIES)



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BASED ON PERSONAL EXPERIENCE AND EXPERT KNOWLEDGE

WITH 1,270 ILLUSTRATIONS AND AN INDEX OF 9,000 ITEMS

EDITED BY

PAUL N. HASLUCK

EDITOR OF "WORK" AND "BUILDING WORLD," AUTHOR OF "HANDYBOOKS FOR HANDICRAFTS," ETC. ETC.

THIRD SERIES

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PREFACE.

CASSELL'S CYCLOPÆDIA OF MECHANICS contains in a form convenient tor ready reference and everyday use receipts, processes, and memoranda selected from a rich store of choice information contributed by a staff of skilful and talented technicians, upon whose practical experience and expert knowledge the information is based. The matter contained in these volumes has been carefully digested, freely illustrated, and made plain to those inexperienced.

All compilations of receipts and memoranda for the use of mechanics that have been published—and some have attained great popularity—differ from the present series in the important fact that almost every item in these volumes is the paid contribution of an expert, written specially to satisfy the want of an inquirer, and each has challenged emendation from a wide circle of practical men. Corrective and supplementary matter supplied by these critical readers has been incorporated to ensure the greater efficiency of this work.

A superficial glance through the pages of these volumes might tend to a false impression that the varied contents are not readily available for easy and systematic reference. However, this is not so. Experience has shown that it is not possible to classify paragraphs that often include matters essentially different so that there shall be a definite place for every item, and the impossibility of such a course is particularly emphasised in the present collection, which embraces subjects widely Even a little consideration of this Cyclopædia would show that no diversified. possible arrangement of the paragraphs would place them so that the several facts contained in each could be found with ease and certainty. The copious indexes provide a means by which every separate particular and detail of any kind dealt with in these volumes may be traced and referred to with the least amount of These indexes also bring together all references to the same subject, trouble. however widely they may be scattered, and all varied notes included under one heading are properly analysed and, thus disclosed, regrouped with kindred topics. No pains have been spared in the compilation of this index, which efficiently serves a purpose impossible to be met by any arrangement of paragraphs comprising the volume.

Amongst the items embodied in this work probably every reader can find some that contain information already known to him. Possibly some readers may be able to supplement the particulars given in respect of matters with which they are familiar. Any authentic supplementary particulars that are likely to be of benefit and that would increase the usefulness of the information will be welcomed, and should be sent to the undersigned.

Additional information or instruction on special details of the matters dealt with in Cassell's Cyclopædia of Mechanics may be obtained by addressing a question to Work or Building World, from the contents of which journals this Cyclopædia has been compiled, so that it may be submitted to the staff of contributors and answered in the columns of one of those journals in the usual course.

P. N. HASLUCK

LA BELLE SAUVAGE, LONDON.

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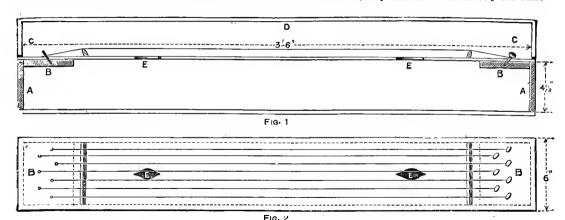
CASSELL'S

CYCLOPÆDIA OF MECHANICS.

(THIRD SERIES.)

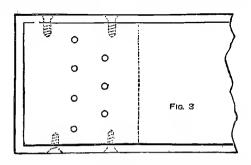
Æolian Harp.—In the illustrations, Fig. 1 represents a vertical section and Fig. 2 a plan of an Æolian harp. Fig. 3 shows the method of fixing the side to the block. First construct the body of the instrument. For this a piece of sound deal ½ in. thick, 8 ft. long, and ½ in. wide will be required. This must be planed, and have its edges truly squared. Cut it into two pieces 3ft. 6 in. long, and two 6 in. long; carefully dovetsil the ends of all these pieces to form the sides and ends of a box. For the top and bottom, take a sound piece of ½ in. or ¾-in. deal, planed up and glass-papered, 7ft. long by 6 in. wide, and cut it into two equal pieces 3ft. 6 in. long. In one piece, which is to form the top or soundboard of

of beech, 5½ in. long by ½ in. by ¾ in., and shave off two edges of each to form triangular pieces on a½ in. base; these must be glued firmly across the face of the sound-board at about 5 in. from each end, and a slight notch made in the top edge opposite to each peg. These will form bridges across which the strings are to be strained. Now get some catgut (violin strings), pass one end through the holes in the iron pegs, carry it over the notches in the bridges, along the face of the sound-board, and attach the other end to the wooden pegs, which turn tightly in their holes until the strings are thoroughly strained. The strings must now be tuned in unison—that is, they must all be of exactly the same



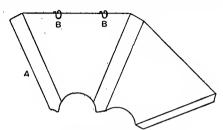
Æolian Harp.

the instrument, at 1ft. from each end, and in the centre longitudinally, cut a hole E (Figs. 1 and 2) about 2 in. in diameter. To strengthen this board for the reception of the pins and screws to which the strings are attached, two blocks will be required. For these take two pieces of beech or other hard wood, 1 in. thick, 5 in. by 4 in. Finish these quite smooth, and attach them to the soundboard on what will be the under side, at \$in. from each end and side as shown at B (Fig. 1). They can be fastened with glue and screws from underneath. This board may now be laid on the framework; the blocks. If properly fitted, will just drop in, and in order to withstand the strain to which they will be subjected, may be further strengthened by two email screws on each side passing through the sides of the box into them (see Fig. 3). The top is fastened to the sides and ends by means of glue and small screws fixed round the edges. The other piece of thin board is now to be fastened to the bottom of the box in a similar manner, and the body of the instrument is complets. Seven iron pegs, the same as used for holding the strings in a plano, and a like number of violin pegswill be required. Bore seven holes in each end of the soundboard into the blocks in the position shown at B (Fig. 2): these should be bored in a diagonal direction, as indicated at O (Fig. 1). See that the pegs fit tightly in the holes, the iron pegs at one end, the wooden ones at the other. Now cut two pieces



sound. As the effect is much enhanced by directing the current of wind over the strings, two pieces of \$\delta\$-in. deal, \$\delta\$in., and a piece of board similar in size to that used for the bottom of the instrument, must be glued on one of the small pieces across the edge at each end of the board. This will stand over the face of the instrument as shown in the unhatched portion in Fig. 1. The instrument should be placed on the window-ledge, and the window closed down on top of it at D (Fig. 1).

Mechanical Lantern Slide.—The device here described is novel and original, and is like a "living picture" in holding the interest for some length of time, but it has distinct advantages, for the performance may he prolonged, or -ven entirely changed, at the will of the operator, while the cost is very small. Prepare a glass cell such as would be used for chemical experiments in the lantern; it should be at least twice as long as an ordinary slide. At the top of this, paint a strip of green into the fin. wide, and half the length of the cell. The strip should be uneven, to represent waves, and at one edge should be transparent; but it must gradually darken till it is quite opaque at the top edge of the cell. A little coral island, say, could he painted, and on the other half of the cell a landscape should be depicted. Out pieces of wood to the shapes of ships, etc., and fit them with masts and rigging of wire sufficiently heavy to cause the ships to float upside-down with the keel above the surface of the water. Sails can he made of tissue paper, varnished to make it waterproof and semi-transparent. Out a piece of glass to the shape of a halloon with the neck somewhat prolonged, and in waterproof colours paint on this the ropes and car, and to the latter cement a thread or fine wire. Then cut a piece of thin zinc to the shape of the figure illustrated above. When folded at the lines a and soldered up, it will form roughly a cone with the apex cut off. The hocks B will prevent it slipping down when placed in the cell. This cone should now be dented at the narrow sides to make it uneven. Next make some transparent solutions of blue, red, and brown colours, and procure a small squirt. Now for the performance: Fill the cell to the edges of the waves with the blue solution, to produce the sky; then place the cell in the lantern with the seascape showing, and drop two ships in the land half which is out of sight. These may now



Mechanical Lantern Slide.

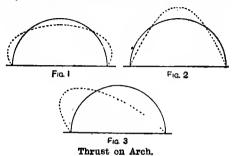
he sailed in by touching the keels with wire or a pencil, and if the water is agitated the vessels will rock. Now slowly insert the zinc cone; this represents the rising of a submarine volcano, and by means of the squirt the red and brown sclutiens are alternately introduced, these heing respectively for fire and smoke. A few tiny bits of cork injected with the fire produce the idea of stones shooting out and falling again. As soon as the sky is too thick with smoke, pour it away and fill np again for the landscape half. In this give a balloon ascent letting this down by means of the wire or thread, which will engreent the guiderope. All sorts of additions will engreat themselves to the operator, such as yacht races, shipwreck, etc. shipwreck. etc.

Gilding and Burnishing Picture Mouldings.—Frames desired with a burnished finish must be watergilt, as oil gilding does not burnish. Washed or gilder's whiting is used for building up a solid foundation, and is mixed with size made from psrchment cuttings, \(\frac{1}{2}\) b. of cuttings making nearly \(\frac{3}{2}\) pt. of size. The cuttings are steeped in cold water for about twenty-four hours, then gently simmered for two or three hours, and strained through muslin. When cold it should form a weak jelly. Patent or double size as employed by decorators, or a size made by boiling pale glue, is often used for first coatings. Mix whiting with strong size till of the consistency of paint, and coat the mouldings with this, using it hot: a second coat may be given when the first is dry, if the wood is soft or open grain. Then the surface being smoothed with glasspaper, canvas, or pumice; it is coated with an oil preparation, namely, raw linseed oil, boiled oil, turpentine, and varnish in about equal parts, with sufficient chrome yellow to give a yellow colour. This is also applied like paint, and a second application given when the first is dry. The portions to be finished black must now be treated with a combination of black spirit varnish and French polishing, the parts to be gilded being then coated with parchment size applied with a camel-hair brush. The process of water gilding differs somewhat from oil gilding, but requires a gilder's cuehion, knife, tip for lifting the leaf, and a skewing brush to skew or force

the leaf into carved or ornamental work. The main difference lies in the fact that the gilding or laying of the leaf may proceed as desired. The surface of the parchment size—as much as can conveniently be handled—is softened with clean water, using a camel-hair brush. Then whilst the surface is still wet, a portion of the gold leaf is cut on the cushion, and by means of the tip is transferred into position, the process of wetting the surface and laying the leaf being repeated till the surface is covered. Take care to let each piece slightly overlap the one previously laid, and as each piece is placed, hlow forcibly against it to expel any water that may lie underneath, and press the leaf to the work. A soft brush or tuit of wadding may also assist in pressing the leaf home. It is a practice in some shops to wet the edges slightly where they overlap; others depend on sufficient moisture being pressed from underneath. Experience will soon decide which method is better adapted for the purpose in hand. The hurnishing is done hy means of an agate burnisher of suitable shape; this is gently but firmly passed along the gold after it has had time to get quite dry. Any idea of burnishing by the aid of machinery is impracticable in the opinion of an expert. Most picture mouldings are imported. Some having an appearance of burnish are worked up cheaply, base metal heing need instead of gold, and others are worked up in silver or white metal to which a golden colour is imparted by means of lac solutions; these are generally worked up on a foundation of plaster-of-Paris, instead of whiting and size.

Thrust on Arch.—Below are notes on ascertaining the

Thrust on Arch.—Below are notes on ascertaining the thrust at the crown of an arch. When an arch is uniformly loaded over the span, the thrust is found by



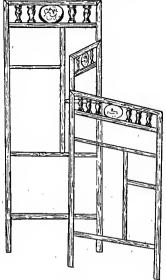
the same formula as that used for finding the flange stress in a girder uniformly loaded, namely, $S = \frac{W}{8} \frac{l}{d}$, W

stress in a girder uniformly loaded, namely, $S = \frac{W}{8d}$, W being the load per foot run, l the span in feet, d the depth of girder or rise of arch in feet, d constant, S the stress in the same terms as W, usually tons. The line of thrust in an arch must necessarily pass through the arch somewhere, but the course of the line depends on the nature of the loading. In an ordinary brick segment arch uniformly loaded, the line of thrust is usually within the middle third of the thickness of the arch rings, and in commencing to set off the line of thrust is the usual method is to start at the centre of the depth. A tie across the bottom of an arched rib does not affect the course of the line of thrust, which is dependent solely on the distribution of the load, and is even independent of the shape or thickness of the arch. The curve of equilibrium or line of thrust, if inverted, is the shape a chain would take when similar loads were acting at similar points to those on the arch, and this also applies when the loads or forces act in other directions than vertical. Arch ribs under unequal pressure and non-parallel loads are very difficult to work out in order to get the line of thrust just where it is wanted. If the load is concentrated towards the sides, the arch rib and the line of thrust will have the relative positions shown in Fig. 1; and if the load is concentrated towards the centre, the position shown in Fig. 2; wh"s, if concentrated more one side than the other, the relative positions will be as shown in Fig. 3. In order to remember the effect, one may say that the line of thrust bulges out to meet the load.

Estimating Length of Rolled Cloth.—In estimating the length of a piece of cloth that is rolled or blocked on a flat board, the length of the average coil of the material is found to be exactly equal to the longest outside diameter of the entire roll multiplied by 2. To find length, multiply by the number of coils. This should be of great advantage to persons who wish to measure materials so rolled without having to resort to the slow process of undoing the roll and then having to measure the cloth yard by yard.

Preventing Nicotine Escaping from Clay Pipe.—
If the fluid products pass through the bowl of a clay pipe, the clay must be very porous; it should only penetrate so clowly as to be burntinto the clay. Dipping the pipe for a few minutes in a solution of silicate of soda might answer the purpose; this will soak into the pores of the clay and fill them up. Another plan is to rub both inside and outside with powdered white French chalk and polish with a rag.

Screen for Holding Photographs.—The accompanying illustration shows a screen on which photographs can be displayed effectively. The screen is made of picture-frame moulding, which could be obtained of any dealer. Old negative glasses are cleaned and immersed one at a time, with a photograph of corresponding size, in a bath of warm gelatine (I part gelatine in 20 parts water). When thoroughly dry, the paper of the print is runhed away from the back with sandpaper (No. 0), leaving the picture thin and transparent. The pictures may now be coloured roughly with oil colours from the back, as in the crystoleum process, and when viewed from the front will be effective, always provided,



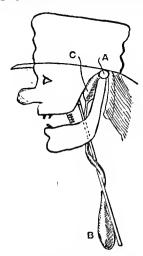
Screen for Holding Photographs.

of course, that the colourist possesses artistic taste. The pictures are then fitted into the frames provided for them, and backed up from behind with white card covered on its ontside with black leather paper. If desired, a margin of gold may be put inside the frames either as a slip, or painted on the glass before mounting the photographs. If the worker has not the necessary artistic skill, the pictures may simply be mounted in optical contact in the manner described, and the colouring omitted.

Manufacture of Washing Soda.—The manufacture of soda ash or crude carbonate of soda, and of washing soda or hydrated carbonate of soda, embraces the chief operations of the alkali manufacture, for which a large chemical works with enormous plant is indispensable. As, however, the manufacture is interesting, a short account of, it may be given here. The raw material is common salt (sodium chloride), and there are two processes of converting this into carbonate of soda. In the older process, known (after its inventor) as the Leblanc process, the salt is heated with strong sulphuric acid in iron pans, or it is heated in a furnace and sulphuric acid and air passed over it (Hargreaves' process), the result being sulphate of soda or salt cake and hydrochloric acid. The sulphate of soda is mixed in certain proportions with coal slack and limestone, and is charged into a revolving reverberatory furnace, and when the reaction is completed the fused mass is turned out into iron trucks and cooled. The solid blocks are placed in large tanks, where they are treated with water, each lot of water passing through several tanks, so that it becomes practically saturated. The solution of impure carbonate of soda is pumped into a tank placed over a reverberatory furnace, and allowed to flow gradually on to the hearth of the furnace, where the water

rapidly evaporates, and the soda ash as it separates is raked to the front till quite dry, when it is raked into barrows. The soda ash is treated with water, allowed to stand, and the clear liquid strained off. It is run into alarge iron bowls kept in a cold room free from dust, here it evaporates slowly and then suddenly solidifies. Washing soda is a pure hydrated carbonate of soda containing more than half its weight of water of crystallisation. In the newer or ammonia-soda process, a solution of common salt is saturated with ammonia gas, and carbonic acid is pumped in under pressure. A reaction occurs with the formation of carbonate of soda (which separates from the solution), and a solution of ammonium chloride remains. The ammonia is recovered from the latter by heating it with lime or magnesia, and it goes into the process again. This account is a mere outline; all the operations are very intricate, and the final product is obtained only after a large amount of skill and labour has been spent on it.

Pneumatic Ventriloquial Head.—The accompanying illustration shows the working of a pneumatic ventriloquial head. The mouth is worked by a pneumatic arrangement similar to that used in working the shutters of photographic cameras. When the bulb B is pressed,



Pneumatic Ventriloquial Head.

air is forced along the tube into the bulb C, thereby opening the lower jaw, which works on the hinge A. The pin by which the head is turned is held in hand with the rubber bulb. A small spring within the mouth shuts the jaw when the pressure is relaxed.

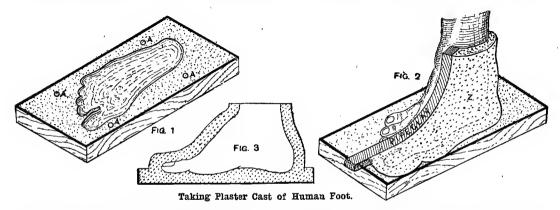
Repairing Nosings of Stone Steps.—For repairing the broken nosings of stone steps, good Portland cement may be used. It should be coloured with an oxide to the tint of the stone, then mixed up rather stiff and applied with a trowel; a short straightedge or rule should be used to work round the nosing till the shape is satisfactory. The fracture should be washed thoroughly clean with water before the cement is applied. The repaired nosing must be protected from injury for at least a week, and the longer protection can be afforded the better. Although the cement makes a very good joh if the work is properly done, the better plan would be to cut the broken piece out of the step (making a neat joh) and let in a new piece of the same kind of stone.

Removing Odour of Soft Soap.—Either nitrobenzol (oil of mirbane) or citronella oil would be suitable for scenting coft soap. The former has the odour of almonds, and the latter of lemons. Only a very little of either would be required.

Substitute for Celluloid,—Considered as raw material for celluloid, potatoes contain about 20 per cent. of starch and 80 per cent. of water. By the action of nitric acid on starch it is converted into a nitro derivative and this nitro derivative is practically the same as nitrocellulose, from which celluloid is made. Hence it is possible to make a celluloid from starch; but, after taking into account the price of the potatoes and the cost of evaporating off the 80 per cent. of water, it will be found that paper or cotton is much cheaper for the manufacture of the nitro-cellulose.

Taking Plaster Cast of Human Foot.—The following are instructions on taking a cast in plaster-of-Paris of the human foot. Procure an oblong wooden box, 12 in. or 13 in. long hy about 5½ in. wide (inside measurement), or just large enough to allow the foot toget in it with about ½ in. or ½ in. to spare all round; lin. in depth will be ample. Gauge some fine stucco or plaster-of-Paris-sufficient in quantity to fill the hox when the foot is resting in it. Pour it into the box, and having brushed over the naked foot some sweet oil, to prevent hair adhering, insert it in the mixturs. Level off the superfluous stucco at the top of the hox, and when the remainder has set, which should be in a few minutes, withdraw the foot. The result will be the footprint or hase section, as shown by Fig. 1. The four small holes A are to form catches for corresponding knobs that will be formed on the two upper parts of the mould. Give the base a coat of shellac varnish to prevent absorption, then run it over with oil. For the half mould Z (Fig. 2) of the upper part of the foot, gauge up some more thick stucco; cut a strip of soft pipeclay and place it down the foot, letting the clean-cut edge form as near as possible the central line. The foot, heim well oiled, should he again inserted into the base mould, and the thick stucco kneaded over half of it, the thickness being kept at about ½ in. A slip of wood may be held along the centre of the heel to act as a butt at the back, in the same way as the clay in the front. These edges may afterwards he squared up with a knife if necessary. When section Z is thoroughly set, remove it and coat it

thicknesses, but all less than I in., which is about the greatest distance an average player will desire. As to the actual curve, it is impossible to dogmantise, but if the reed is placed in position it should, when closed by pressure, close the aperture gradually and completely, this cannot be the case if the curve has any ahruptness. Since for even the highest sound there must be some aperture, it may be true, as some assert, that the top in. may he quite flat, but the rest of the distance must be an "easing curve" to which the flat on which the reed is fixed is a tangent. As the reed is stouter towards the fixed end, it is almost certain that the form of the mouthpiece should be a portion of an ellipse. Many mouthpieces will not bear the test here proposed, but it will be easy with a slip of oilstone or water-of-Ayr stone slightly to ruh down the side of the aperture that is the closer, as tested by the thin sheet metal or stiff paper. There is another consideration—that is, the position of the flat, or table, in relation to the grain of the wood. It seems reasonable that a clarionet mouthpiece should have the table parallel to and on the bark side of the timber and not diagonal to it, just as a jouner's trying-plane is made. Reeds should he a full straw colour, not orange, nor lemon with a trace of green, nor dull huff. If a reed is roughened by wetting it, throw it away. Held up to the light, it should show a regular gradation towards a semi-transparent tip. It is better if cut from a cane of about 1 in. in diameter than of a smaller size. It has heen found that the tube of a clarionet cannot



with varnish and oil as before. The other half is taken in a similar manner. The foot is again rested in its base, section Z is placed in its position, and the strip of clay heing removed, the remaining portion is moulded to shape. The mould will then be complete, and any number of casts may be taken from it. Fig. 3 shows a section of the mould complete. Fit the three parts together, and tie them round with a piece of string to keep them in position. Gauge sufficient stucco, of about the consistency of thick cream, to fill the mould, pour a little into it and shake it well, so that it may penetrate into and fill up all cravices. Pour in some more and again well shake it, then fill up with the remainder and allow it to set thoroughly hard. When the mould is taken apart, a perfect reproduction of the natural foot should be the result. It may be either varnished or left which according to taste.

Clarionet Monthpiece.—The distance in a clarionet between the mouthpiece and the reed must depend on three conditions, namely (1) the stiffness of the reed, (2) the tension of the player's lips, and (3) the amount of available wind for playing. The distance from the tip to the point of contact of the reed with the mouthpiece need only be enough to obtain the lowest nots on the clarionet. Now \(\frac{1}{2} \) in is sufficient, but a longer aperture gives a better tone. There are other considerations, and \(\frac{1}{2} \) in in sufficient, but a longer opening permissible, and the lowest note is almost always good with a fair reed. The most important condition is that the curvature of both sides of the mouthpiece is identical. To test this, hold a piece of best plate-glass in contact with the mouthpiece and try a cut strip of writing paper under it; note the distance to which it can be inserted. It should stand at right angles to the centre line of the bore. A little water on the flat part with the glass plate is true, and whether the springing begins equally on both sides. Everal pieces of sheet metal flattened and having edges free from hurrs may be tried. These should be of various

proved by cutting away the whole of the back of a mouthpiece, and it was thereby discovered that the highest tones must be obtained from a fairly stiff reed, and not from one that has lost its elasticity through long use and through the continued moisture to which it is, of course, subject.

Mixing Colours for Coach-painting.—For coach-painter's greens, use coach green, imperial green, permanent green, or the imperial green made by mixing together emerald green and ivory black. A variety of greens may be prepared by mixing together ure prussian blue and lemon chrome. A very deep or dull shade can be obtained by adding ivory black or hurnt turkey umber. For blues, use ultramarine and prussian blues; the former is used in its pure state, whilst the latter may be tinted or made paler by adding white-lead. For brown, use raw and hurnt umber, also vandyke brown. For yellows, pale lemon or middle chrome are used. Tan colour is a mixture of turkey red and burnt sienna, or venetian red and burnt sienna. These must be ground very finely to obtain good results. The above colours are obtained in paste form ground finely in turpentine; they are then thinned down ready for use with 3 parts of turpentine and 1 part of body varnish. The method of thinning or mixing the pigments varies according to the class of work required.

Curing Moleskins.—A quick and most effective method of dressing mole and other small skins to render them soft and supple is as follows. Whilst they are freshly stripped from the trunk, steep them in a strong colution of American potash in water, until the upper skin is removed, care being taken not to leave them too long in the liquid. Then dry them in sawdust, which will aheorb the moisture. Finally, neatsfoot oil, with a small addition of camphor or oil of birch, which imparts a pleasant smell, is applied sparingly to effect entire softening. A final application of henzoline and a brisk hrushing will remove the surplus oil, and hring out the natural gloss of the fur.

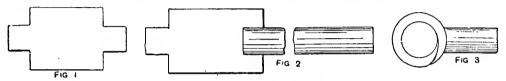
Estimating Wood in Wardrobe.—In measuring up the amount of wood used in making a wardrohe, to find its exact cost, the various items should be treated in order, and entered on a sheet of paper ruled as below, making due allowances for working. All pieces of the same thickness should he taken first, the items of each stove, but they soon polish up again after enamelling. To enamel successfully, first see that everything (brushes, enamel, stove, enamelling room, and bench) is clean, and that the worker's clothes are free from dust. Sprinkle the floor with water before starting, and dust the inside of the stove, rods, and hooks

| | No. | Width. | Length. | Thick. | Totals. | Reduced Foot Run. | |
|-----------|-------|-----------------------|----------------------|-----------|--|---------------------------------|--|
| St. R. | 4 4 2 | in. 3 3 11 | ft. in. 6 0 1 10 6 6 | in. 1 1 1 | lft. by 6 ft. by lin. lft. by lft. 10 in. by l in. lft. 10 in. by 6 ft. 6 in. by l in. | Yellow. | |
| | | | | | 3ft. 10 in. by 14ft. 4in. by 1 in. = 54 ft. 11 in. super. = | 73ft. 3in. by 9in. by 1in. | |
| | 2 6 | 111 ₂ 5 | 5 8 4 0 | 0} 0} | lft. llin. by 5ft. 8in. by ½in. 2ft. 6in. by 4ft. by ½in. | Pine. | |
| | | | _ | | 4ft. 5in. by 9ft. 8in. by ½ in. = 42ft. 8in. super. = | 46 ft. 6 in. by 11 in. by ½ in. | |

length being totalled, and the several totals added to flud the sum. The dimensions are then multiplied together to find the superficial content in square feet, and then reduced to running feet either '9 in. or 11 in. wide. Yellow and white deal are reduced to 9 in., and pine and basswood to 11 in., as these woods are always sold by the foot run of those widths; mahogany and other hardwoods need not be reduced, as they are sold by the foot super. as 11n. thick. For doors, measure from edge to edge plus ½ in. for the length of the rails;

frequently. Flat brushes about 11 in. wide should be used.

Forging Backband Hooks for Shafts.—The simplest way of making iron hackhand hooks for shafts is as follows. Take a piece of 2-in. or 2\{-in. by \(\frac{2}{3}\)-in. by \(\frac{2}{3}\)-in. in. in. conclude the length required to form the eye, and cut it to Fig. 1, scarfing down the ends. Get a piece of \(\frac{2}{3}\)-in. or \(\frac{2}{3}\)-in. round iron, thicken the end by jumping up, and weld it to the flat iron as shown by Fig. 2. Then bend



Forging Backband Hooks for Shafts.

allow Itin. on stiles, and tin. on finished widths for waste. For panels, measure the neat length and width between the inside edges plus lin., and for the carcase take the total height net, but on the width allow tin. extra. Allow tin. on drawer fronts and backs, and take the net depth of drawer plus tin. on the width. For the bottoms, measure from outside to outside. All mouldings, fillets, bearers, etc., are estimated by the foot run by the greatest dimensions, plus the width for each mitre. To ensure that no part has been overlooked, initial each item, as R for rail, St for stiles, etc. To reduce superficial feet to foot run of 9 in., multiply by 12 and divide by 9; to reduce to 11 in., divide by 11.

Annealing German Silver. — German silver and similar alloys are annealed by the application of heat regularly and equally during manipulation. It may he done over a brazier's gas hearth. Another plan is to use an ordinary annealing oven. Articles placed in the oven would be regularly heated, and when cooled may be worked again as necessary.

Stove Enamelling Cycles.—For stove enamelling cycles, prepare the work by well cleaning with emery cloth, dust thoroughly, and then wipe over with a cloth soaked in turpentine. Give a coat of first coating enamel, then stove for three-quarters of an hour at 300° F. to 350° F. Rub down with powdered pumice and water, using a piece of alpaca for the purpose, then wipe over with a rag, followed by a perfectly clean rag free from fuff or loose pieces. Coat with Mander Bros.' finishing enamel, and stove at 380° F. for an hour. This should be sufficient for repairs or cheap work. For est work, repeat the rubhing down with pumice, etc. Give another coat of fluishing enamel, and stove as for the second coat. The work must now be hand polished with black rottenstone and water; this requires great skill and practice, and generally results in a dull finish when attempted by an amateur. It is not necessary to varnish the black work, but coloured enamels are sometimes varnished after the last coat, and stoved for half an hour or so. The plated parts cannot be prevented from getting discoloured in the

the flat part over the bick iron, drive in a drift of the desired size, and with a set hammer work the ends of the flat piece round the drift until it forms theeye as shown by Fig. 3. Now take a heat, weld in the scarfs on the shank, drive in the drift, weld the scarf on top of the eye, clean up, and cut off to leugth.

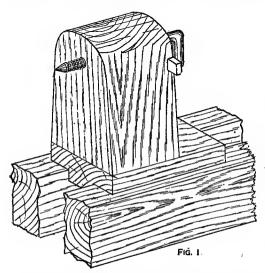
Stability of Foundations.—The question of the stability of the foundations of huildings, etc., proves a complex ene. The under surface of the structure producing the pressure on the foundations may be apparently acting uniformly, because the weight above may be uniformly distributed; but as the material supporting the weight can escape more readily at the sides than in the centre, there is reason to suppose that the pressure as p, the maximum in the centre will not be uniform. Taking the average pressure as p, the maximum in the centre will be about $16\,p$, and the minimum round the sides about $08\,p$. The average pressure is what is usually calculated and allowed for. Rankine's formula is based on the natural slope or angle of repose of the various soils, as their supporting power will vary with their tendency to slip away from the formula, $P = w x \left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2$, P = maximum vertical pressure in pounds per square foot, x = depth below

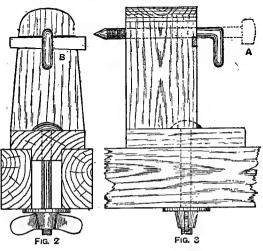
formula, $P=wx\left(\frac{1-\sin\phi}{1-\sin\phi}\right)$, $r=\max$ mathem versual pressure in pounds per square foot, x= depth below surrounding surface in feet, w= weight per cubic foot of earth in pounds, $\phi=$ angle of repose of earth, safe load $=\frac{1}{3}P$. Take the case of a heavy hallast, say w=120 lb., x=4 ft., $\phi=45^\circ$, then P=7.27 tons, and the safe load = say $\frac{1}{2}$ tous per square foot. The great difference produced by the variation in the angle of repose, or, in other words, the firmness of the soil, is shown by the change in value of the expression $\left(\frac{1}{1-\sin\phi}\right)^2$, which for $\phi=15^\circ=2.89$, $30^\circ=9.00$, $45^\circ=33.94$, $60^\circ=193.8$. An approximate formula is as follows. $P=\frac{\phi^2}{4000}\times d$, where P= the safe load in tons per square foot on the base of the foundation, d= depth in feet below the surface immediately surrounding, $\phi=$ angle of repose or natural slope of the earth in degrees. The formulæ are applicable within all ordinary limits.

Stoving or Japanning Tin Trunks, Cans, etc.—
The paints used for stoving such goods are of the best and purest quality, ground to a paste in oil. They are thinned down with turgentine, and a small quantity of japanners' gold-size is added to bind them. The articles are then painted in the desired colours, subjected to a slight heat until thoroughly hard and dry, and then varnished with japanners' hard copal varnish, placed in a stove, and subjected to a temperature of about 240° F. for from one to two hours until they have the desired finish, the time required depending on the quality of varnish employed. For a white paint, use zinc white or white-lead; for green, use Brunswick or chrome greens; for chocolate, use 7 parts of Indian red and 1 part of black. The quantity of each for 71b. of paint will he:—Pure paste paint 5½1b., turpentine about ½pt., and japanners' gold-size ½pt. Best paint will stand hot water for a limited time, but will not resist the action of boiling water, especially where any soap or alkali is present.

Wooden Tailstock for Lathe.—A wooden tailstock for a lathe is shown by Figs. 1, 2, and 3. The body part is in two pieces; beech or birch or similar hard wood will be suitable. The centre may be formed of a bolt with a

lens) the ground glass. An old unused photographic plate with the silver fixed out can be used, after dyeing, for the blue glass. With the glasses in this position (keep the glasses in place by rubher bands or other simple contrivance) place the slide in the camera grooves, draw both shutters, and focus the picture. The ground glass is then removed, and its place in the slide is taken by a sensitive plate, the blue glass heing kept in frout as before. This work is done in the dark room. The blue glass is placed in front of the sensitive plate for the purpose of absorbing the yellow light, because all the rays of light used in forming the image on the sensitive plate must pass through the blue glass before reaching the plate. The photographic plate is much less sensitive to yellow than to any other light, and consequently those parts of the picture that are yellow are represented in the negative by more or less transparent patches that ultimately print black. Now if those portious of the picture that ought to be white have become yellow, and eventually show black in the print, such a picture must look flat, being without contrast, and the mind receives the impression of little more than form only. By introducing the blue glass the yellow rays are filtered out, and contrast is to a





Wooden Tailstock for Lathe.

wooden thread made conical as shown. It may be used with the head as indicated by the dotted lines A (Fig. 3), but as it would require a spanner for turning, the better plan would be to get a smith to turn down the end of the holt as illustrated. If care is taken in horing a hole and the screw is made to fit fairly light, it will not become loose by the revolving of the work; but a simple contrivance to obviate this is to cut a slot in the back of the vertical piece as shown at B (Fig. 2), so that a metal wedge can fit in the slot and up against the holt. This can be tightened or loosened by a tap with the hammer.

Coating Cycle with Aluminium Paint.—Previous to applying the paint the machine should be thoroughly cleaned, all the old enamel scraped or burnt off, and the metal well rubbed down with emery cloth. Two coats of paint should be given, the first coat being rubbed down smooth with powdered pumice and water and thoroughly dried and dusted before applying the second coat. It will add to the durability and appearance of the job if a coat of pale oak varnish be given. To apply the paint, use a flat soft badger or camel-hair brush. Do the work in a warm room free from dust and draughts, and if an enamelling stove is available, stove each coat at about 200° F, for half an hour or so.

Copying Faded Photograph.—A copy of a photograph may be even better than the original, and may possibly show more detail; but any parts of the picture that have entirely disappeared cannot be restored. The method described below will in most cases give fairly good results. Fasten the copy to the board in a good full light. A blue light or a light rich in violet rays, such as an electric arc light, or even hurning magnesium ribbon, is preferable to daylight. In the dark slide place first a sheet of glass coated with gelatine stained faintly with methyl blue, and immediately on this blue glass place (rough side towards the

large extent restored. A process plate (that is, a plate specially made for giving extreme contrasts) should generally be employed, and if care is exercised the best possible results will be obtained. The following method of restoring the original photograph has been suggested, but cannot be recommended. Tungstate of soda 10gr., distilled water 500 c.c. carbonate of lime '25 gr., chloride of gold '1gr., distilled water 10 c.c. Allow the lime, etc., solution to stand for twenty-four hours, then filter and mix with the soda solution. Well wash the prints, and place them in this hath for ten minutes; when the prints have assumed a purple colour, transfer to tungstate of soda '5gr., hyposulphite of soda 1gr., water 25 c.c., and wash.

Tying Lashings to Poles.—Assuming that two 6-in. poles are to be connected at the head to make a pair of shear legs, get a piece of 2-in. rope ahout 30 ft. long. After laying the poles down on the ground at the proper angle, the rope should be tightly bound (by taking a couple of turns) round the joint, and the loose end then passed over the top between the poles so that the subsequent coils hold the end firmly. Then continus the binding for say half-a-dozen turns hefore passing the rope over and under in the other direction; continus this for at least four turns, and then pass the end through the part that first turned over and under. A wedge may then be driven between the rope and the poles in such a manner that the thick end of the wedge is upwards when the poles are raised. Two short ropes of 20 ft. each may, if desired, he used instead of the one long rope. The operation is rather difficult to describe, and the worker should endeavour to examine some lashings. The end of a rope is kep! from fraying by serving it with twine. Twine is also used for tying a loose end in place where the thickness of the rope is too great to hold the end by reeving through a previous turn.

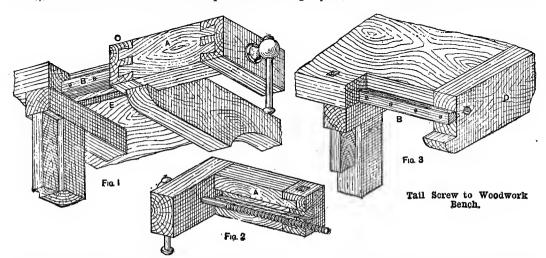
Tempering Steel Paper-cutters.—If made of cast steel, heat the cutters to a blood-red heat, cool out in water that has just got the chill off, rub them up bright with sandstone, then let them down on a piece of hot Iron to a deep purple at the cutting edge. When let down to the desired colour, dip them in oil or rub some tallow over them, and lay them on one side to cool. If the cutters are made of double shear steel, treat them as described above, but only let them down to a medlum straw colour. If they are too hard, try cooling them in oil and then flaring down; but to be successful by this method requires practice. method requires practice.

Shoemakers' Brown Wax.—To make brown wax as used by shoemakers boil together till thoroughly amalgamated equal quantities of pitch and resin; then pour in some boiled linseed oil (cold, of course), and mix well. Try a small quantity in cold water; if of the proper stiffness, pour it all in, and pull well hand over hand till it floats. Cut in lumps. The quantity of oil used varies according to the season and weather.

Tail Screw to Woodwork Bench.—The conventional views herewith show one form of tail vice for woodwork bench where the side cheek A (Figs. 1 and 2) has a dovetail groove sliding on the dovetail runner B (Figs. 1 and 3). The end and side cheeks are lap-dovetailed

with dry pads and whiting. (c) To polish a tusk with the outer skin removed, with a smooth half-round file draw-file the tusk till the white ivory appears, using the flat or round side of the file, as the curve of the tusk will allow. This should be followed by scraping, which must be done with quick firm strokes, or the surface of the tvory will become rippled, causing the file to be brought into use again, and destroying the symmetry of the curve of the tusk; a cabinet-maker's well-sharpened scraper will do the work well. After scraping, finish with wet whiting as described for process (b), followed by dry whiting. (d) Lathe-polishing of ivory is done with revolving brushes, fed with wet whiting, and the final polish is given with a linen dolly fed with dry whiting.

Sweet Making.—The utensils required for making chocolates and other sweets are a clean copper pan, a small furnace or a ring gas burner, stirring spoons, a marble or bright irou slab, a roller, and shears. The raw materials are ordinary white sugar, brown sugar, glucose, tartaric acid or cream of tartar, flavouring essences, colouring matters, and, for toffy, butter. For boiled sweets, place in the pan a weighed quantity of the sugar and just cover it with water; place the pan on the fire and allow the contents to boil, continually stirring to prevent the mass burning or boiling over. At an early stage a pinch of tartaric acid or cream of tartar must be



together, and also the return piece C. The end plece D forms a clamp to the end of the top, and is secured to it by dowelling. The box or nut for the screw is secured to the back of this piece, and when the top is from 24 in. to 3 in. thick a chase has to be made on the under side of it for the screw, as shown at E (Fig. 1).

Cord used in Bookbinding.—Ordinary parcel twine is used by bookhinders for sewing books on. Select a 3-ply variety that could also be easily opened out and scraped with a knife. When lacing the boards to the book the cord is pasted and scraped out with a knife, so that after being laced into the board it will hammer down flat and leave no unsightly marks. The cord must be thin enough to lie flat within the saw grooves in the back of the book.

Polishing Ivory Tusk.—There are many ways of polishing ivory tusks, both with the bark or outside skin left on or cut through to the white ivory, by simple polishing as with spirit varnish, and elaborate polishing by abrasion and friction. The process may be simplified by the use of a polishing lathe; in its absence hand work must be resorted to. (a) Well scrub the tusk with a hard brush, using hot water in which a little washing soda has been placed, and soft soap, rinsing well with clean water; dry before a fire or in the sun, and give two coats of transparent spirit varnish, letting the first coat dry off well before applying the second. (b) To polish with the bark left on the tusk, clean up as for (a) and rub well with No. 2½ emery cloth, following with No. 1½, finishing with the finest emery cloth; rubbing always lengthways of the tusk. Next procure some pieces of old blanketing or thick cloth and some ordinary whiting; mix the latter to a thick paste and begin the polishing wet. Let the rubbing pads be well soaked in water, and constantly add fresh whiting to the pad and rub vigorously. When all scratches have disappeared, continue the rubbing

added. Continue the boiling until a little of the sugar, taken out on a clay-pipe stem and dipped in cold water, is hard and brittle, then pour the mass on the slab, roll it out, cut it into strips with a knife, and, when moderately hard, cut up with the shears; by using these diagonally, diamond-shaped sweets are obtained. For acid and lemon drops, use more tartaric acid, with the addition, for lemon drops, of a very little essence of lemon just before pouring; for pear drops, use amyl acetate, etc. Colouring matters are added in minute quantity at starting; suitable harmless colours are sold by confectioners' sundrymen. For chocolates, a warm mortar and pestle and a warm slab are used. Mix together in the mortar to the cousistency of a uniform paste, 11b. of good cocoa and 6 oz. of powdered sugar; roll this out on the warm slab, make up again in the mortar, and take out portions with a spoon. Form neat drops on white paper laid on trays, and place in a cool place to set. In making bars and fancy designs the chocolate pasts is ladled into tiuplate moulds, the paste being shnken down by tapping the moulds, and then allowed to set. The making of chocolate creams and fancy chocolates of course requires experience and skill. (See also Series II., p. 185.)

Applying Gold Paint to Wood.—In applying gold

Applying Gold Paint to Wood.—In applying gold paint to wood, much depends upon the medium used in the preparation of the gold paint. A simple method is to rub the surface down with No. 0 glasspaper, dust well, then give a coat of chrome paint made by mixing middle chrome paste paint to a proper consistency with boiled oil 4 parts, oak varnish 2 parts, turpentine 1 part. This paint should be applied thinly and evenly and allowed to dry hard. Should any brush marks appear, rub lightly with No. 0 glasspaper, dust well, then apply the gold paint with a camel-hair or sable brush. The chrome paint forms an excellent ground for the subsequent coats of gold paint. quent coats of gold paint.

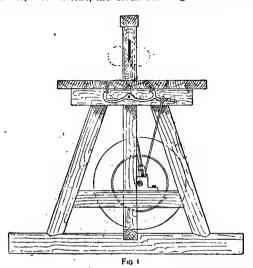
Rectifying Heavy Touch of Piano.—If the heavy touch is more apparent in the centre of a piano keyboard, it probably is due to a slight twist of the hammer rail or key frame, thue bringing the keys and action mechanism into closer contact. If the keys are furnished with regulating screws under small pieces of cloth glued at the extreme end under the action, or are fitted with capstan regulating studs, try the effect of reducing the friction by turning down the screws or studs; remove the action and burnish the partse that come in contact, using blacklead and a burnisher.

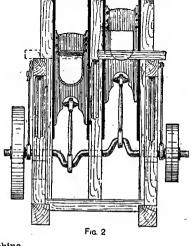
Firewood-splitting Machine.—Figs. 1 and 2 show side and front views of a firewood-splitting machine that has been calculated to split 10 cwt. or slightly more of wood per hour. It is assumed that a wooden construction is desired, and that second-hand iron fittings are to be used. No sizes are given, but the general proportions shown in the drawings should be observed. In Fig. 2 the wheelwork and connections of the feed arrangement (except the eccentric rods) are omitted for the sake of clearness. In Fig. 1 the feed arrangement is indicated by dotted lines only, but an automatic feeding arrangement is essential in the completed machine. The feed is, of course, intermittent, the block standing still while

quantity of japan gold size as a binder. The engine should be given one or two coats and then finished off with a coat of hard durable copal varnish. All paints should be carefully strained previous to using, otherwise the work may have an irregular or gritty appearance.

Substitute for Sea Salt.—Sea water has been found to contain the following salts in every 100 parts. Sodium chloride (common salt) 2'64, potassium chloride '0'5, magnesium chloride 315, magnesium sulphate '2, calcium sulphate '13, and traces of other salts which need not be included. To make up such salt, all the materials must be in a fine powder, and they should be intimately mixed, otherwise the material will be variable. The quantities are common salt 264 lb., potassium chloride 3'lb., magnesium chloride 3'lb. 24 oz., magnesium sulphate 3 oz., and calcium sulphate 2 oz.

Repairing Bronze Figure.—To mend a broken bronze figure satisfactorily, place a small quantity of solder on the face of the broken parts, hold the two together and heat from (preferably) a Bunsen burner. When the solder runs, press the two parts together and hold them firm till set. The mark may then be





Firewood-splitting Machine.

the knife is descending. The blocks are passed forward through one of the openings and cut into slabs; they are returned through the other opening and split into sticks. The crankshaft is placed so that the shock occurs while the connecting rod is straight. The various castings (if the construction is to be a new one) could be obtained from almost any sawmill machinery maker, and are nearly similar in pattern to those used in double-deal frames. A disused saw frame, too much worn for accurate sawing work, would do admirably for a firewood-splitting machine, the feed shafting, pulleys, etc., being nearly identical in each case, a small adaptation as to the working bench and knife being all that would be necessary. Most sawmills have one such lying about that might be purchased cheaply. The machine would be power driven, of course.

Dyeing Wool Chestnut Colour.—For dyeing wool chestnut colour dissolve 2\frac{1}{2}\line{1}\text{lb.} of acid brown in 4 gal. of water; in this place the wool and bring gradually to the boil; then wring out and pass through cold water, and again wring and dry. Before dyeing the whole of the wool, try a small sample to see whether the shade is satisfactory.

Painting Engine.—Before painting an engine, rub the greasy parts with benzine to remove all traces of grease. Should any of the parts be blistered, apply over the paint a solution made by dissolving \$\frac{1}{2}\] lt. of caustic soda in 1 pt. of water, and allow it to stand until the paint softens, when it may easily be removed and well washed down before painting. The paints to be used should be mixed with oak varnish and gold size, 4 parts of the former to 1 part of the latter, with a small quantity of turpentine added. Colours ground in turpentine may also be used, adding a small

covered over with bronze solution (ready mixed) in which a little black is mixed till the right shade is obtained. A very fine camel hair pencil should be used for applying the solution. If the article has been well soldered there should be but the slightest mark showing the joint.

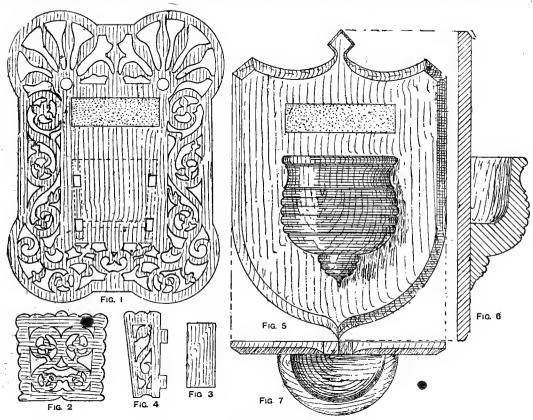
Steamer for Sancepan.—If a steamer is to be made to fit a saucepan, it is usual to bend a length of wire round to the same shape as the saucepan, and fit this wire a little loosely to the rim of the saucepan cover. The wire is then straightened out and used as the length for the steamer body, and also used for wiring it. If a saucepan is made to fit a steamer, the wire is bent and fitted to the steamer rim, and then used for the saucepan hody length as described above. The usual depth for a steamer body is about fin., but this, of course, varies according to conditions.

Lubricating Oils.—The chief lubricating oils used for machinery, etc., are petroleum oils of high flash point, and vegetable oils such as rape, castor, olive, etc. in preparing such oils the principal thing to take into account is the kind of machinery for which they are to he used. For very light machinery and high velocitiesvery fluid oils, such as mineral oils, are employed, either alone or in mixture with olive oil. For medium class machinery, rape or castor oil, or heavy petroleums, are used, and for very heavy machinery, fats such as tallow, and greases made from tallow or resin oil mixed with lime, also palm oil, etc. As petroleums are usually very fluid they are often mixed with 'hlown' oils—that is, castor, rape, or cotton-seed oils which have been artificially thickened by blowing air through them during heating. Some particulars of mineral lubricating oils are given in Series I., p. 319.

Use of Woodworker's Plough.—The plough is a very necessary tool in the construction of any framed work, such as bookcases and wardrohes; it is also esseutial in making joints, which, without its aid, must generally he made with nails, a very unsatisfactory method when the work is to be polished. An efficient substitute for a plough in many operations would be a 1-in. grooving plane; this might be utilised for tongued joints (although the tongue would be relatively too large), grooving for panels, working rebates, einkings, etc.

Wall Matchboxes.—The fretwork matchboxillustrated by Figs. 1, 2, 3, and 4 is made of white hard wood \$\frac{1}{2}\$ in. thick, the back (Fig. 1) measuring 6 in. by 4\frac{1}{2}\$ in. thick, the block of the side pieces of the pocket should be sawn out as shown, Fig. 2 illustrating the front of the pocket, Fig. 3 the bottom, and Fig. 4 the side pieces. A small piece of emery cloth or glass cloth is glued above the pocket, as shown at Figs. 1 and 5, for striking the

line representing the linings, keeping them parallel with the length rod. Next cut the plinth between these fillets very tightly, and mitre in the architraves; cut these off long enough to make the mitres around the openings afterwards. Next line off the top edges of the frieze rail and the dado rail parallel with, and at the required height above, the plinth; mitre these iuto the architrave. Take the sizes of the panelling and cut the battens off to size, hand tight; remove the mouldings and clean off. Having finished all the bays in this manner, commence fixing; level and scribe down the plinth if required, fix the fillet at the back, and preferably make a groove \$\frac{1}{2}\$ in deep to receive the skirting fillet. Fix the plinth by nailing near the top edge into the ground backings; offer up the architraves and mitre them around the openings. Fix them by bradding at back and front in the slnkings, insert the lower panels in the rebates, and spring in the frieze moulding on their



Wall Matchboxes.

matches. In the simpler design (Fig. 5), the shield or back piece may be of some dark wood, and the pocket or cup turned of a lighter hued material. Walnut or teak for the shield, and holly or sycamore for the pocket, are very suitable, and look well. Of course, two pockets will be made from one turning, as shown by the section, Fig. 6. The shield is 6½ in. long by 4½ in. wide, and the edges are bevelled as shown in Figs. 5 and 6.

Fixing Dado Framing.—The following gives some idea as to the hest way of fixing a dado framing 4ft. high, with batteu panelling and planted mouldings, the latter finishing flush with, and mitreing to, the architraves of the windows, etc., all the grounds heing fixed. The door and window linings, forming part of the architraves, may be looked on as the vertical boundaries of the deeign, and should be fixed first, in the usual way, to firrings or grounds, care being taken to keep the face edges plumb and at the required projection as found by applying a piece of the architrave to the ground. Having fixed all these, take on a rod the clear length between the adjacent linings and between linings and return walls, and set out the panelling upon a wide board or upon a clean floor. Nail a fillet down, each

face; the latter may be bradded, or screwed in pelleted holes; afterwards insert the top panels and fit in the dado rail. Every third or fourth board should be nailed to the grounds, the others left loose to swell and shrink. The backs of all should be painted. Finally, fit the skirting slips into the grooves tightly, and brad the top edges to the plinth.

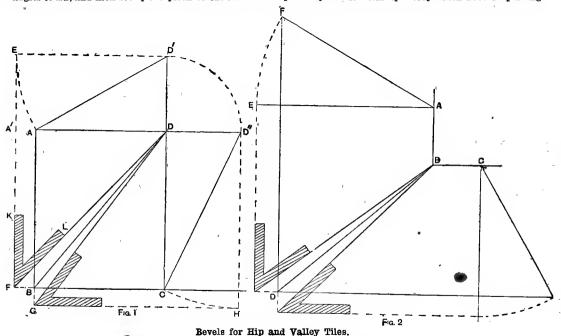
Tar Varnish for Galvanised Iron.—The following preparation may be used for preserving galvanised iron, and is easily and cheaply made. Melt together in a suitable iron vessel over the fire 71b of coal-tar pitch and 11b. of coal tar; slowly add ½ 1b. of quicklime, after which the temperature should be raised and the contents well stirred; this removes all traces of free acids. Now add 1b. of lampblack and ½ gal of holled oil, stir well and allow to cool down, then remove well away from the fire, and add cantiously 3½ gal. of coal-tar naphtha. After being allowed to get cold the preparation is ready for use. This varnish dries hard in about four hours with an excellent glose. It is necessary that no light or fire be near when adding the naphtha, as it gives off a vapour which is highly inflammable and travels speedily along the ground.

Treating Oak to Imitate Bog Oak.—The following are instructions on giving to ordinary oak the appearance of bog oak. (1) If the articles are small, suspend them for a few hours in a pickle made of freshly slaked lime and common washing soda, 21h. of soda to 1 gal. of limewash. If it is more convenient to apply the liquid with a brush, a common fibre brush will be most suitable. Swill off with plenty of clean water, and, when the articles are dry, brush over with common vinegar before applying any varnish or polish. (2) Vandyke brown mixed into a thin paste with liquid ammonia and thinned out with rainwater. (3) Two ounces of hicknomate of potash dissolved in 1 pt. of hot water. The above will give shades of dark brown merging to blackness. For a black colour an ebony stain is advised. Experiment on odd pieces of wood similar to that to be treated till the desired tone is obtained.

Bevels for Hip and Valley Tiles.—A geometrical method of obtaining the hevels for cutting tiles to hips and valleys is shown in the accompanying illustration, and it will be found correct for any plan or pitch. Let ABC (Fig. 1) he the angle of the plan of the corner of the roof and BD the plan of the hip. Draw AD at right angles to AB, and then set up the pitch of the roof AD'.

side and head are similarly treated. Whilst these harden the lid is taken in hand. Returning to the carcase again, the varnished surface is smoothed down with worn glasspaper, and the polish rubber used, this time with a rag covering, a few drops of glaze being added to impart a bright finish instead of spiriting out. If a particularly good surface is desired a second coat of varnish may be applied when the work is taken up the second time. This will of course necessitate the work being handled three times instead of twice, apart from the process of filling the grain.

Furniture Woods.—For constructing a bedroom suite with a limited stock of tools the best hardwood to use is Honduras mahogany. The grain of this wood is fairly homogeneous, straight, and not too open; if the wood is dry it does not cast or twist, is fairly easy to work, is of good appearance when polished in its natural colour, and may easily be darkened to any shade, or, if desired, stained to imitate either rosewood or walnut. Of the hardwoods, oak comes next in ease of working and appearance, but is difficult to keep from warping. Black or American walnut is rather a difficult wood to work, and an inexperienced worker would probably find it "tear up" very much both in planing



Draw D'E parallel to AD, making D'E equal to AD' as shown. Now project down from E parallel to AB to meet CB prolonged in F. Then A'FD is the development or true shape of the portion ABC of the plan of the root, and the bevel KFL that which is required, because FK is parallel to the horizontal joints of the tiles and FL is parallel to the oblique edges meeting at the hip. The is parallel to the horizontal joints of the tiles and FI is parallel to the oblique edges meeting at the hip. The method of obtaining the hevel at G will be exactly similar to that already described. In Fig. 2 are shown the bevels for the valley tiles, A B C being the lines of the plates and B D the plan of the valley. The pitches, etc., as will be seen, have been set out on the same principles as previously described, and the bevels obtained by developing portions of the roof surfaces.

Wood Grain Filler for Coffins.—As a wood grain filler for coffins melted Russian tallow with a quantity of plaster-of-Paris and a trace of yellow ochre added for colouring purposes will be as good as auything if it can be kept handy for use, but if the worker has to make a journey to the workshop and carry the materials with him, whiting mixed with turpentine or linseed oil, with the addition of a small quantity of polish just at the moment of using, is a splendid substitute. The first few rubhers of polish are applied by the polish rubber without a rag covering, and should be worked out fairly dry. The coffin, resting on ledges overhanging the front of the work-bench, is worked upon one side and the foot, and then hodied up and a coat of varnish applied. The coffin is then turned over and the other

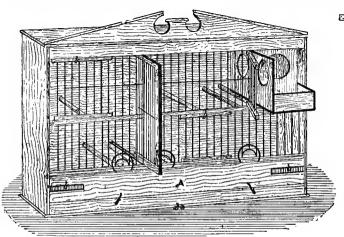
and glasspapering. Ash also is a very tough and difficult wood to work, but when finished properly has a handsome appearance. For staining purposes, there is nothing better than American yellow pine; it is easy of working, inexpensive, stands well, will stain any colour, polishes well, takes glue admirably, does not split, and its only drawback is that it is very soft and easily damaged; therefore working parts should be edged with a harder wood, such as oak or mahogany. Basswood is somewhat harder, works easy, is cheap, takes stains well, polishes well if properly "filled," but is very liable to warp and twist. Cowrie, or Australian pine, is an excellent all-round wood, fairly cheap, but at times difficult to obtain. American whitewood, which is often confounded with basswood, is a cheap but uncertain wood to handle, and requires considerable care in purchasing; some samples will work as easy as pine, whilst others are more difficult to clean up than oak. White deal (spruce) is unsuited for furniture making, except in the case of table tops or shelves; it is the cheapest wood in the market, but is difficult to work in consequence of the hardness of its knots. It swells and shrinks with every change in the weather, polishes and stains well, and splits easily.

Saddlers' White Wax.—To make white wax as used by saddlers take equal quantities of wax (as used for hest white wax candles) and white lead and place in a vessel in an oven to melt; regulate the stiffness by using more or less wax.

Hard Gunmetal Alloy.—A mixture of copper 90½ lb., tin 91b., and phosphorus ½ lb. is very hard and suitable for axle bearings, cogwheels, and ali parts exposed to much friction. The phosphorus must be added to the alloy in the nature of phosphor tin, if the phosphor tin can be obtained of 10-per-cent. staudard, which some makers guarantee; otherwise part phosphor copper and part phosphor tin must be used. Taking a 10-per-cent. alloy of tin and phosphorus, melt the ingredients in the following manner. Melt 90½ lb. of copper in a crucible, and when ready add 2½ lb. of tin, and afterwards ½ lb. of a 10-per-cent. alloy of phosphorus and tin; keep a layer of charcoal on the crucible, and pour as soon as possible. If this alloy is too hard, use the following. Copper 92½ lb., tin 71h., and phosphorus ½ lb., using the phosphortin alloy to add the phosphorus. ½ lb. of phosphorus would be contained by ½ lb. of 10 per cent. phosphortin, so therefore ¼ lb. of tin would be required as well as the alloy.

Cage for Breeding Canaries.—The drawing shows a single-partitioned breeding cage, 22 in. long, 16 in. high, and 12 in. deep. The cage may be made into a two-three-, or more partitioned one by making it longer in proportion to the number of partitions; practically, Il in. should be allowed in length for every portion that is to be partitioned off. To construct the cage, a box hould be made the required size out of size region as should be made the required size out of \{\frac{1}{2}\in.\text{or}\}\{\frac{1}{2}\in.\text{deal}\},

and over it a strip of ordinary P.O.P. The sunned piece of P.O.P. should be cut in half and fastened to the back of the frame, so that the piece of paper being printed will always fold back on it and be easily compared for the tint. Expose to the light for a time, and the paper will darken down beneath each step to the same tint as the sunned piece or guide, the thinnest step, or that marked 1, tinting first. A few experiments will soon show which tint is suitable for an average negative, and this tint is afterwards used as a guide. Another and a better plan, but one involving more time and skill, is to make a gradation scale by actual deposits of silver in the manner described below. Across an ordinary quarter-plate printing frame place a number of strips of card, and cut them to fit together exactly as shown in Fig. 2. Strips B and C hold the others in position. Place in the frame an ordinary slow dry plate with all the strips closed. Now erect the frame facing a candle at a distance from it of 3ft. See that the candle burns steadily and is not in a dranght. Draw out the strips one at a time in regular order, givinf such strip an exposure of 1, 2, 4, 8, 16, and 32 seconds respectively. On development in pyro. 4gr., sodium sulphite 40gr., sodium carbonate 40gr., potassium bromide ½ gr., and water 2 oz., a regular series of densities will result. Now make on a film six little photographs of a clear line copy, keeping the impressions at distances apart exactly equal to the



Cage for Breeding Canaries.

Fig. 1 32 9 ñ m -R : Fig. 2 Photographic Actinometer.

planed all over. The bottom part A, together with the centre and top hars, should be cut to width and length and drilled together, so that when the wires are threaded through they will run parallel. The nest boxes are made to slide in and out, a small door opening to admit of their doing so. If desired, Hyde's patent feeders may be used instead of the round wires for the bottles. A wire may also be laced in the middle of the top and centre bar to strengthen the wirework. Before inserting the wire front, the box should be well limewashed inside; the outside may be coloured or enamelled as desired. The cost of wire, wood, and brads should not exceed 3s. 6d. The wire may be obtained from any ironmonger, tinned wire being used as a rule. Any dealer in bird seed or bird requisites can supply the cups; and for wood, apply to a dealer in fret-woods or at a sawmills.

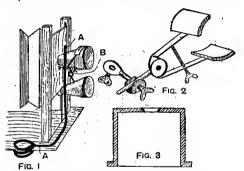
Photographic Actinometer.—An actinometer is an instrument for measuring the actinic or chemical power of light. Papers such as carbon need development to render the picture visible, therefore some means of measuring the light is necessary in order to know precisely when the chemical change is so far advanced that it may be satisfactorily completed by the developer. To make a simple actinometer, prepare ten pieces of tissue paper in wide, the difference in the lengths of successive pieces being in. so that the longest piece will be 5in. long and the shortest piece in the longest piece will be 5in. long and the shortest piece in the oneste, beginning with the longest, so that they form steps as shown in section by Fig. 1 (an old stripped negative can be used as the support). Then sun down a strip of P.O.P. (about 5in. by 4in.) to a medium tint, and tone, fix, and wash as usual. Write on each of the steps (using Stephens' ebony stain or other opaque ink) a number from I to 10. Now put the glass containing the steps in the frame,

width of the strips of deposited silver. (The manner in which this is done is fully described in Series II., p. 168.) Then put the gradation scale face up and over it the duplicated copy, so that one impression comes on each patch of density. Next place over this strip of impressions a strip of similar width of P.O.P. and expose to the light. The impression that must print up clearly to show when an average negative is printed in carbon will be found easily after a few trials. The simplest form of actinometer that will serve as a rough guide for a beginner is to place a strip of P.O.P. across a negative of similar printing density to the one in use. When the silver paper is lightly printed the other will he done also. No allowance must be made for loss in toning and fixing.

Varnishing Photographic Negatives.—Negative varnish is used thus. Warm the negative before a fire or above a gas jet until just hot to the back of the hand, then slowly pour a pool of varnish into the centre of the plate, and tilt the plate to allow the varnish to flow gently to the top right-hand corner, next to the top left-hand corner, thirdly to the bottom left-hand corner almost touching the thumb by which this extreme corner is held, and, lastly, from the bottom right-hand corner pour the surplus varnish gently back into the bottle. Drain for a few seconds and stand up to dry. The plate should not be rocked during the draining. If the varnish is so thick that it forms streaks unless rocked, thin with a little methylated spirit, but do not add too much or the varnish will chill off and dry with a matt surface. Varnish is generally supplied a little too thick for use and becomes worse as the solvents evaporate. After draining, dry for a few minutes with a slow heat. Varnishing negatives requires a little practice; most operators make the mistake of trying to do the work too quickly.

Fixative for Drawings.—A fixative for pencil, chalk, or charcoal drawings is composed of gum juniper or clear resin and methylated spirit in the preportion of 1 oz. of gum or resin to 1 pt. of spirit. As charcoal drawings are too delicate and easily rubbed off for this fixative to be applied with a brush, the preparation is blown on with a spray, which may be bought at any chemist's. It is advisable, when applying the fixative, to stand about 2 ft. from the drawing, which should be set up in a vertical position. If the spray is held too near the drawing, there is a danger of blowing the fixative unequally and in heavy patches, which may tend to disfigure the work. A simple way to fix a pencil drawing is to give it a wash of skim milk.

Photographing Distant Landscapes.—Any ordinary camera and lens may be used successfully for landscape work. Landscapes are usually fairly well lit, and therefore a smaller stop than is required for other work may be used; this is equivalent in many respects to using a proportionately better lens. A lens of fairly long focus (that is, a lens whose length exceeds the diagonal of the plate) should be used for preference, for with such a lens objects are represented larger and in better perspective. This exaggeration in perspective is confined to the near objects, so that if only the centre of the field is used, the result when enlarged will be identical with a picture taken with a lens of longer focus. To produce good landscapes, the photographer must study the rules of composition and of light and shade as set out in Burnet's "Art Essays," Bir Joshua Reynolds" Discourses on Art," Robinson's "Picture Making by Photography," etc. The photographer should master development and printing and be able to



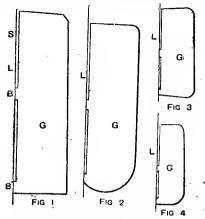
Photographing Distant Landscapes.

expose correctly and tastefully mount and finish the picture. These points are of more importance than the apparatus used for obtaining the picture, provided the camera has the ordinary movements. In a camera which is lacking in extension, something in the nature of a telephoto lens must be used for distant scenes. One barrel of an opera-glass forms a very useful makeshift long-focus or telephoto lens, and is suitable for distant landscapes. Fig. 1 shows a convenient method of using this lens. A is a stout wire bent to form a clamp and easily slipped over the end of the baseboard. Attached to A is an ordinary screw clamp B (see also Fig. 2) gripping the barrel of the glasses. A small box with beading on each edge, as shown in Fig. 3, is made to run in the grooves of the sliding front to increase the extension when required. In the end of this box is a hole lined with black velvet into which the end of the barrel fits exactly. Slip in the box front, unserew the eyepiece again from the inside of the camera. A little practice will be required before the extension can be properly adjusted, and then a few trials will be necessary in order to find how much nearer to the lens the plate must be moved after focussing in order to bring the plate into the position of the chemical focus. (As the lens will not be corrected for photography the chemical and visual foci do not coincide.) Choose a clear day, use slow plates, and remember that the exposure is less for distant objects.

Photographing for Reproduction.—Photographs for half-tone reproduction must have great contrast with perfect gradation, and this is best obtained by using slow plates such as Barnet ordinary, and developing with pyro-soda. A good formula is pyro 4gr., sodium sulphite 4gr., sodium carbonate 4gr., water 2oz., potassium bromide 4gr. Some fairly dark blue velvet or tapestry forms a good background; if tapestry is used, it should be artistically draped. The trophy should be placed on a table covered with a cloth without pattern, and of

nearly the same shade as the background. A piece of ice placed inside a silver cup causes the surface of the silver to become sufficiently dull to prevent reflection. When the trophy presents a large space of plain metal, the lens should be made to peep through a hole in a dark cloth hung up in front of the camera, otherwise the silver will show on its surface an image of the camera. The exposure must be calculated for the object, and not for the background, and in the absence of experience is best found with the aid of an actinometer. As a guide for future use, records should be kept of the exposures and of the results. A negative that is suitable for process reproduction should also yield a good enlargement. But in preparing a negative specially for enlargement, development should not be carried quite so far as for a process negative, and the gradations in the high lights should be preserved. Perfect focussing is imperatively required in both cases.

Gauges for Setting Circular Saws.—Gauges for setting circular saws may be made from a piece of an old thin hand-saw. Shapes of setting gauges are shown at G (Figs. 1, 2, 3, and 4). With a chisel, first cut the piece roughly to size, then secure it in a vice and file to shape. Be careful to file perfectly level, or the set will not be equal on each range. The parts B (Fig. 1) bear against the saw-plate, which is denoted by the line L. The space between the plate and the gauge gives an idea of



Gauges for Setting Circular Saws.

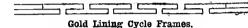
the amount of set required. The tooth is twisted until the point touches at S. Fig. 1 is a profile of a gauge (half size) suitable for saws from 46 in. to 60 in. in diameter. Set easy to the gauge when setting the smaller saws, and stronger as the saws increase in diameter and thickness. When cutting wet or resinous timber, give a little stronger set. The gauge shown at Fig. 2 is suitable for saws from 30 in. up to 60 in. Gauges for smaller saws should he made suitable to their diameter, thickness, etc. Figs. 3 and 4 are suitable for swage saws; Fig. 3 for saws from 30 in., and Fig. 4 from 20 in. up to 30 in. Set very easy to the gauge when setting the teeth in the smaller saws, and on the bevelled side set stronger to the gauge than on the other side of the saw.

the gauge than on the other side of the saw.

Glazing Drain Pipes.—Only strong refractory clays that will stand a high temperature are fitted for salt-glazing. Though the process is simple, a number of experiments will doubtless be necessary before a satisfactory result is obtained. When the ware has beeu fired and the kiln is at its full heat, and the fire-holes are bright and clear, a small shovelful of rough salt is thrown into each fire-hole, which is then banked up or covered over. In about an hour the process is repeated, and a trial drawn to see how the glaze is progressing. The salting is again repeated, if need be, and, when considered satisfactory, the kiln is given a final firing and allowed to cool down, a process which may take from twenty-four to thirty-six hours. The same amount of heat required to volatilise the salt would vitrefy ordinary red clay, with the result that the bricks or ware would be stuck together in one mass. In certain yards, where the fireclay is of a particularly refractory nature, it is customary to add a small proportion of red clay. The proportion will, of course, vary according to the nature of the clay, and to ascertain it is a matter of experiment. The advantage of using a small quantity of red is that, since it will flux or vitrefy before the white is very hard baked, it tends to bind the particles in the white together.

Bending Lead Pipes with Bobbins.—A bobbin used for bending lead pipes consists of an egg-shaped piece of very hard wood, a little smaller in diameter than the bore of the pipe that is to be bent. Followers are small pieces of any kind of wood a little smaller than the bobbin. The bobbin is placed in the pipe and driven by a wooden or other kind of rod until the bend is reached. Followers are then inserted, one at a time, and driven by the rod until the bobbin has passed round the bend and has reached the other end of the pipe. A ball of lead, brass, iron, or other heavy material is sometimes used instead of the rod for driving the bobbin. The pipe is stood in such a position that the ball falls into the bobbin, the pipe being then reversed for the ball to run out and de again allowed to fall; or the ball is jerked up and down inside the pipe. A rope with a knotted end is sometimes passed through a hole in the bobbin, and the free end of the rope wound round a small drum fixed on the end of the bench; the small drum is turned by a winch handle, and the bobbin is thus dragged through the pipe and removes all bruises and contracted parts such as at the bends. These methods of bending lead pipes are not at all good, as the heel of the bend is made thin by the bobbin, and the throat of the bend is made thin by the bobbin, and the throat of the bend is made thin by the skilful use of dummies and dressers, all bends can be so made that the thickness of the metal is maintained on all sides and for the whole length of the lead pipe.

Gold Lining Cycle Frames.—For putting bright gold lines on cycle frames with gold leaf, a good gold size is necessary, and this is made from \$1\text{h}\$. Inseed oil, with 20z. of gum animi, the latter being reduced to a powder and gradually added to the oil while boiling. Boil until as thick as tar, and strain through a coarse cloth. For use, add a little vermillon, and thin with oil of turpentine. Bright gold lines are put on with isinglass. About a quarter teaspoonful of fine isinglass is dissolved in half a cup of boiling water; then, before it is cold, fill the cup



with spirit of wine and strain through silk. After the gold leaf has been put on, run the isinglass size quickly and freely over the lines with a pencil. If applied hot, it enhances the brightness. Gold lines put on dead with a gold size or varnish are burnished with an ordinary agate burnisher, using a piece of thin India paper or silk between the burnisher and the work. The following is very effective. Three lines \(\frac{1}{2} \) in. apart are put on with gold leaf. The two top lines are cut at intervals of, say, lin., and the bottom line halfway between, as shown by the sketch. A little dead-black is used to cut the lines, and the whole is finished with a coat of varnish,

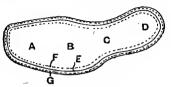
the sketch. A little dead-black is used to cut the lines, and the whole is finished with a coat of varnish,

Measuring Painters' Work.—The correct method of measuring painters' work, such as doors, window frames, etc., is to measure whatever is painted, allowing all returns, panels; etc., stating the number of coats of paint, the finished tint, and if flatted; also if in two tints. Should the mouldings be cut in, collect them by the foot run; if clearcoled, specify the same; if on new plastered walls, describe the same. All painting should mean and include knotting, stopping, preparing, etc. Narrow widths under lain., and having two edges, are cut in and taken by the foot run. Door faces (per yard super.): Take the width of the door, including the architraves and returns, adding lain. for every panel by the height from the floor to the top, inclusive of architrave and any grounds. Collect the length of the jamb linings by the widths, adding rebates and thickness of the door; if both sides of the door are painted alike, double the dimension. Wainscotings or panelled dados (per yard super.): Multiply the length by the height, and add lin. for all panels, etc., in height only. Window fronts, boxing shutters, etc. (per foot super.): Take the width, including the returns, dead to the walls by the height from the floor to the top, adding any projection that may occur; take the height of the shutters by the width, adding 2ft. 6in. for the edgings inside of the boxings, etc. Collect the whole dimensions of round of elbow caps by Il0 in. in width. Calculate the sash squares by the dozen, specifying coats; sashes and frames are numbered, stating how many coats. Reveals: Take the heights and soffits by the foot run. Cornices (per foot run): Collect the round; if above 14 in. in girth, take them by the foot super., if under, by the foot run. Particularise if caryed or euriched; add one third. Skirtings (per foot run): Take the dimensions of the rooms, describing whether square or moulded. Strings of stairs, handrails, newe

similar way. Rainwater pipes, etc. (per foot run): Add up the lengths of rainwater pipes, eaves, and gutters, and add 2ft. 6in. for cistern heads, and 1ft. 6in. for shoes. Say how many brackets. Ironwork: Iron, or any other description of railing, is measured as square work. Collect the lengths by the heights; if painted all round, double the dimension. All bars, brackets, etc., are numbered.

Cleaning Papered Ceiling.—Paper that has been on a ceiling for years, and especially if gas-burnt, probably will not clean, but the following method, which answers for wall-papers, may be tried. With a soft-bristle broom remove as much of the dirt and dust as possible, and then rub over the surface of the paper with baker's dough; as the dough gets black with the removed dirt, work the black part into the clean until the dough is all dirty, then take a fresh piece and continue rubbing till the whole area is clean.

Infants' Sewround Shoes.—Here are instructions on making infants' sewround shoes. First of all well wet the leather and then let it get half dry, secure one sole, grain side inwards, to the last by four tacks, as A, B, C, D, and trim it up. Now remove it from the last and put the two pieces together, grain to grain, nail them on a cutting board, the trimmed piece on top, and cut out the bottom piece exactly to the top piece. Then tack the soles on the board separately, grain downwards, and take a sloping piece of all round the edge, as shown by the middle line E, so as to have the edge of the sole about half its original substance. This is best done by drawing with compasses a line all round about for in, from the edge, then draw



Infants Sewrounds.

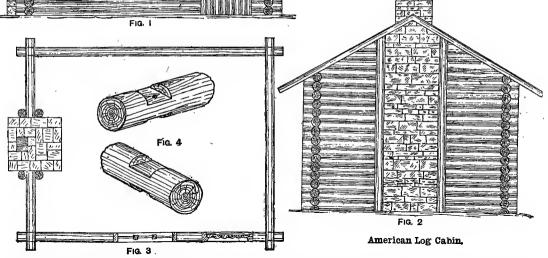
another line \(\frac{1}{2} \) in. inside the first line. Make a row of holes, bringing the point of the sewing awl just above the edge of the sole; that is, put the awl in at \(\frac{1}{2} \), and just let the point show at \(G \). After this has been done to both pieces, the soles are fitted. Side linings and etifieners are fitted as for other boots, in proportion to the size and substance of the work in hand. The soles are then tacked, grain down, on the lasts and the shoes are then tacked, grain down, on the lasts and the shoes lasted. All single-sole work is lasted inside, outside; for instance, the left shoe is made on the right last and vice versa, then, when sewn and turned, the shoes are re-lasted on their proper lasts, finished off, removed from the lasts, and socked in the usual way. The whole of the above, up to re-lasting, has to be done while the sole is fairly wet; if allowed to get dry, it must be damped again with an old toothbrush.

sole is fairly wet; it allowed to get dry, it must be damped again with an old toothbrush.

Repairing Valve of Oil Lamp Pump.—For repairing the valve of the pump of a Primus oil lamp it will of course be necessary to take out the valve. Examine the interior of the pump-barrel, and if a small flat-sided projection on the bottom of the pump is seen, that is the end of the valve; and if a long key with an aperture in the end, which is made to just fit over the projection above mentioned, be passed down the pump-barrel, the valve can be unserewed, repaired, and reiuserted. If there is no projection, the pump-barrel will have to be taken out. If the part of the pump-barrel will nave to be taken out. If the part of the pump-barrel will unscrew from the reservoir, and the valve on the end can then be adjusted. If the pump is not hexagonal at the head, the lamp is of an early pattern, and the pump will have to be unsoldered before it can be ramoved. Gently heat the pump with a blowpipe flame until the solder melts, then pull the pump out. Before commencing this operation, drain all the oil from the reservoir, and leave the feed-cap off while removing the pump, and keep the cap opening away from the operator while using the blowpipe, as the smallest amount of oil remaining in the reservoir will be converted by the heat applied to gas, and if the flame catches this a slight explosion in the reservoir will occur, the flame from this shooting upwards through the feed-cap opening. The defect in the valve may be from three causes: the cork washer may be worn out; the spring through much use may have become weak; or dirt may have worked into the valve and so rendered it nusound. The obvious remedy before replacing the pump would be to fit a new spring or washer, or thoroughly to clean the valve.

American Log Cabin. — The illustrations show a common form of log cabin built up of small straight tree trunks. The usual method of joining the straight tree trunks. The usual method of joining the timbers at the angles is to let the ends run over and notch a quarter of the thickness out of each side of each piece, as shown in Fig. 4. These logs can be further secured by boring with an auger through each log into the last log fixed, and driving in a wooden pin. Of course, if nails are obtainable, the work would be expedited. If a chimney is required, it should be built of some local stone or similar material. But American

feed-block. The feed-block moves forward into the firing position, the fresh cartridge and the empty case are placed in the barrel chamber, and the ejector tube and the extractor are moved upwards by the side levers acting on the extractor levers, the empty case remaining in the extractor tube and being held thers by the extractor spring until it is pushed out by the next case. Then the jib slides over the base of the live cartridge until the firing pin-hole is opposite the cap, and a fresh cartridge, automatically moved up, comes into position in the feed-block. The rifle-calibre Nordenfelt guns are fed by means of upper and lower hoppers, the latter being more often termed the distributors. They are constructed of steel plates, with the exception of the rear face and guides, which are of gunmetal. The lower hopper is placed on the gun on the top of the breech cover over the carrier block, and secured in position, where it remains during the firing, by means of a spring lock. The lower hopper, or distributor, has a separate compartment for each barrel, and on the rear face of each compartment is a guide for holding the cartridges by their rims. The cartridge lies in an inclined position with the bullet slightly raised and touching the front inner face of the distributor. The upper hopper also has separate compartments, and is loaded from the top, a hinged cover being provided for the purpose. The cartridges are kept on the hopper by means of a catch running the whole of its width, in rear, at the bottom. This catch can be thrown in or out of position by a handle on the left outer side hopper. A similar arrangement of catch is used for the distributor. The empty lower hopper or distributor being fixed in its place, an upper filled hopper is then placed on



stoves with piping are sometimes used for the purpose. The roof is often formed by splitting the logs in two, as shown, and is covered with some kind of material (handy or easily obtainable) that will render the roof waterproof. The expedients adopted for making the inside of the structure draught- and waterproof are various, and depend upon the district and the resources of the builder. The sizes of the cabins vary according to requirements. Fig. 1 represents the front elevation, Fig. 2 an end view, and Fig. 3 the plan.

Feeding Maxim and Nordenfelt Guns.—The Maxim and the Nordenfelt guns are automatic, the Maxim having a single barrel, and the Nordenfelt from one to ten barrels. The Maxim gun is supplied with ammunition by means of a belt holding 250 cartridges. The belt passes through a feed-block on the right-hand side of the gun, and is caught by pawls, which hold it and pass it to the left. A cartridge is withdrawn by the extractor, and brought into line with the barrel as the extractor falls. The belt is furnished with projecting brass strips to show how far the cartridges are to be inserted, and each strip is thickened at the edge next the bullets, so that the cartridges may be kept parallel in passing through the feedblock and may lie even in the ammunition boxes. When the gun has fired, the recolling portion travels forward and moves the upper pawls on to the feed-block slide to the left, and brings a fresh cartridge into position in the Feeding Maxim and Nordenfelt Guns.-The Maxim

the top of the lower one, and on the catch handle being pushed down the cartridges are released, and thus fall into their respective compartments in the distributor. When the catch of the distributor is released a cartridge for each barrel falls on to the carrier block, the others continuing to supply their places as soon as a vacancy occurs. By means of the catch the distributor and upper hopper can be taken off separately at any time without the cartridges contained falling out. This method of feeding is very simple and certain; and the cartridges being contained in a closed case, any chance of the gun being fouled by dust collecting on the cartridges is obviated.

Yellow Glazes for Leather.—For bright yellow glazes for leather, (1) dissolve loz. of gum sandarach and loz. of orange shellac in \(\frac{1}{2} \) pt. of methylated epirit; then stir in sufficient aniline yellow (soluble in spirits) to colour. Strain and mix with the whites of four eggs; apply quickly and evenly. If required, thin down with methylated spirit. (2) Dissolve 12 oz. of shellac, 2 oz. of resin, 5 oz. of Venice turpentine, and 4 oz. of spirits of turpentine in 96 parts of methylated spirit; add 1 oz. of aniline yellow and stir well; then pass through a fine strainer, when the mixture ie ready for use. Apply with a camellair brush. If a light shade is required, add aniline yellow; for deep colour add a very small quantity of Bismarck brown. Thin down with methylated spirit.

Poplar or Aspen Wood.—Aspen or poplar wood is white in colour, easy to work, and finishes with a smooth, glossy surface. It is soft, very light in weight, and does not burn readily. It is used for wooden ware, for heads and handles of house brushes, for shelves, boxes, and corn-bins (mice do not nibble it), and very frequently for partitions, stalls, and flooring-boards in outhouses and farm buildings.

Colouring Cinematograph Films.—The simplest plan for colouring cinematograph films is to use aniline dyes. The film is stretched between two clips over a board having a small hole in the centre, beneath which is a reflector or an incandescent lamp. By using this device the film is in a horizontal position, and the light shines through the picture. Washes of the dyes are then applied with a brush, any sxcess being removed with the edge of a piece of blotting paper. To colour these films in a really effective manner requires considerable skill and pattence, and the results are always rather disappointing. Of course, only general effects are aimed at, and not minute detail.

Concrete Bed for Engine.—In a concrete bed for an engine, hand holes are to be left for tightening the bolts. The size of the bed is 54 ft. 3 in. by 9 ft. 4 in. by 6 ft. thick. The timbers may be fixed by previding, say 6 in. by 4 in. uprights 10 ft. apart, let 1 ft. into the ground with cross pieces at the top to hold them to the gauge, as

mass, and in such cases the statement of support will not hold good unless the centre of gravity point be connected with the body. In plain words, the centre of gravity of any figure is that point about which the figure balances. The centre of gravity of two weights, or areas A and B, placed l distance apart, will be x distance from A when

 $x = \frac{\mathbf{B}}{\mathbf{A} + \mathbf{B}} t.$

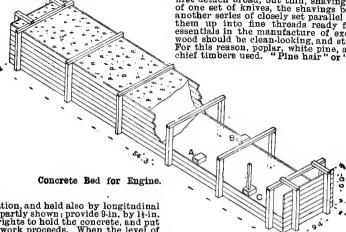
The centre of gravity x of a number of bodies in a straight line with regard to any point A at one end of line, W being the weight and z the distance of W from A,

A $x = \frac{Wz + W_1z_1 + W_2z_2 + \dots}{W + W_1 + W_2 + \dots}$

On this principle all cases arising in practice are worked out, but sometimes one method and sometimes another is better suited to the particular case.

is better suited to the particular case.

"Excelsior" and "Pine Hair."—"Excelsior" is the name given to the very finely cut and ribbon-like wood shavings used for packing all manner of delicate objects. A dozen different kinds of machines are used for reducing the rough lumber to the fine finished product. The work is carried on chiefly in America. After cutting the rough logs off to the right lengths, peeling the bark off, and chipping out all knots and discoloured places, the wood is placed aside to dry thoroughly. Meanwhile, other dried blocks are passed through the machines, which first detach broad, but thin, shavings by the operation of one set of knives, the shavings being conducted to another series of closely set parallel cutters which split them up into fine threads ready for use. The first essentials in the manufacture of excelsior is that the wood should be clean-looking, and straight in the fibre. For this reason, poplar, white pine, and spruce are the chief timbers used. "Pine hair" or "pine wool" is also



shown in the illustration, and held also by longitudinal pieces on the top, as partly shown; provide 9-in, by 14-in, boards inside the uprights to hold the concrete, and put the boards in as the work proceeds. When the level of the under side of the hand holes is reached, wooder boxes ABC of the required size are laid in, with upright boxes, say 3 in. by 3 in., to form the core for the bolt holes, one of which is shown in the illustration. These core hoxes should be carefully fixed to the template or measurements. The concrete should be put in in layers not exceeding 12 in. deep, no layer to extend more than 3ft. in advance of the layer above.

Ridding Water Pipes of the Odour of Gas.—Iron pipes- temporarily employed for a gas service and subsequently used for a domestic water supply may cause the water to be tainted with the odour of gas. The odour will probably soon disappear, but in the meantime a solution of permanganate of potash might be tried. Purchase at an oliman's a pennyworth of permanganate of potash and dissolve it in a good pallful of warm water. Run this solution through the pipes, then flush them with plain cold water. Do not allow any of the undissolved permanganate to enter the pipes, or further trouble will be experienced in trying to rid the water of the pink colour caused by the undissolved grains of the permanganate remaining in the pipes. Fermanganate of potash used in this way is harmless. If necessary try the effect of running a pailful of limewhite through the pipes. Make this lime-white with fresh (quick) lime and water; and the solution should be about as thick as good milk.

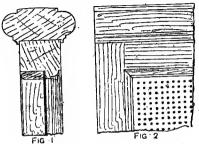
Definition of Centre of Gravity.—The centre of gravity may be defined as that point in a body through which the resultant of the gravities (or weights) of the parts of that body passes, in every position the body can assume. If the centre of gravity be supported, the centre of gravity is supported, the centre of gravity is not necessarily situated in the solid portion of the body, nor enclosed by its surfaces; the centre of gravity is simply the mean central point of the

of American origin. It is a fibrous preparation of the long, needle-like leaves of the true pitchpine, and of other pine trees that have very long foliage. The leaves are subjected to the action of special machines that clean, dress, and split up the "needles" to the requisite degree of fineness. The material is sold in four grades, A, B, and C, a coarser article D being used as a substitute for real hair in plasterers' work. The finer grades are used for upholstering purposes and for weaving into mattings and carpets. The finest "pine wool," especially, is claimed to be the nearest approach to natural wool ever made from vegetable fibre. It takes and retains dyes without the need of a mordant, while the "pine hair" is clean and sweet, has a healthy balsamic odour, is permanently antiseptic, and goods manufactured of it are said to be absolutely verminproof. As a bye-product in the preparation of pine hair and pine wool, pine dust is becoming well known. It is used as a fertiliser, and contains a high percentage of ammonia.

Moulds for Sealing Wax.—A brass mould for sealing wax is a flat block cast with depressions on the face of it the size of the sticks. These depressions should be very slightly tapered, and the casting must be smoothed and polished. A little oil applied by a rag before casting will help to remove the sticks, but the taper shape of the depression is essential. The wax should not be hotter than is necessary. Iron moulds would probably do provided they are properly tooled and polished. The sticks are cast quite plain, and when a name is to be applied the sticks are laid on sheet-iron trays and placed in an oven hot enough to just soften the wax, and whilst the wax is in this condition the impression is produced by applying a small hand stamp to each stick.

Monnting Photographs on Plush Blocks.—Albumen paper is most suitable for photographic prints that are to be mounted under glass on plush blocks. Thoroughly clean the glass support and lay over it a thin sheet of perfectly flat metal in. smaller each way than the glass. This metal will form a mask for the centre of the glass and leave a clean edge, when a brush charged with oil colour is run around the glass. Varnish when dry. (The better plan is to purchase these glasses ready prepared. They can be had in set sizes of any dealer in photographic materials, and are known as opaline glasses.) Place the glass in warm water, and make up a 5-per-cent. solution of No. I gelatine and keep it warm. The print, which must be trimmed somewhat smaller than the glass support, is, together with the glass, are immersed in the gelatine, are brought into contact under the surface, withdrawn, covered with a sheet of rubber backing, and stroked into close contact with a flat squeegee. See that no air bells (which show like bright specks from the front) appear on the print; if any are found, stroke them out by gentle pressure with the squeegee. When dry, back the print with a sheet of waterproof backing paper, sponge off the gelatine from the front of the glass (using warm water), and, after again drying, the opalins is ready for glueing to its support.

Perforated Window Blinds.—Window blinds in wire gauze or perforated zinc are made as shown by Figs. 1 and 2. A light mahogany frame fits into the opening of the sash frame between the beads, the latter being usually 1½ in. wide, so that the blind frame from the face to the outer edge of the capping should measure 1½ in. The



Perforated Window Blinds.

moulding on the inner edge or next the glass should be cut in between the sash stiles. The blind is fixed by two blind bolts, one at each end of the capping, the bolt shooting into the bead on the sash frame. For panels, either gauze or perforated zinc is used, preferably the hatter, especially when writing is to be done on the panel.

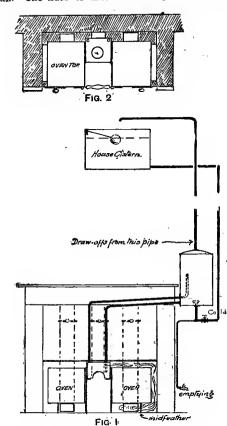
Taking Apart Shuttle Race of Sewing Machine.—
To take apart and, after it has been cleaned, replace the shuttle race of a Singer sewing machine it is necessary merely to remove the race from the machine and then take out the two screws on the back. The shuttle is put in with the race, and it is only necessary to have the needle-bar at the top of its stroke when the shuttle (if put in the race with the point about level with the centre of the top part of the race) will slip into place quite easily. To adjust the height of the needle-bar, fix it so that when at its lowest point the eye of the needle is just above the shuttle driver.

Testing Brazed Joints of Cycle Frame.—Cycle frame tubes could be tested by standing on the pedals, but this is not an absolute test. A top brazed joint—that is, one in which the brass has not run into the joint, but only round the top—would probably stand any amount of pulling or twisting; but the vibration while riding would crack the brass—the joint not being solid—and the tube would naturally come out of the lug. The only way to be sure of a good brazed joint is to clean the parts, peg, heat sufficiently, and see that the brass runs into the joint, and that it is filled up, making the two parts solid.

Colouring Gelatino-chloride Photographic Prints. Golouring Gelatino-chloride Photographic Prints.—For colouring gelatino-chloride prints so as to leave them glossy like ordinary uncoloured prints, it is usual to employ ordinary water-colours mixed with gum to match the surface of the print. Dissolve a few lumps of gum arabic by gentle heat in a small quantity of water, filter, and add this to the paint employed. The following is a fairly complete equipment of colours.

Rose madder, crimson lake, venetian red, light red, vermilion, vellow ochre, cadmium yellow, Naples yellow, raw sienna, burnt umber, warm sepia, cobalt, Prussian blue, ivory black, and Chinese white, but different artists will obtain the same effects with different mixtures. Sets of colours for photographic work can be obtained of any large artists' colournan. A popular method of colouring is not proper painting, but merely a trick of dabbing over solutions of aniline dves.

Fixing Kitchener and Hot-water Pipes.— The manner in which a kitchener, with hot water to sink and bath, is fixed, is shown by the accompanying illus-trations, of which Fig. 1 illustrates the range, boiler, and pipes in elevation, and Fig. 2 the range in plan. The flues of kitcheners vary a little in size



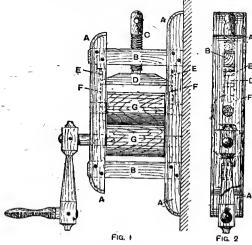
Fixing Kitchener and Hot-water Pipes.

according to the sizes of the ovens and the fire, but the back upright flues may be safely made the same size as the dampers sent by the range maker. The sides of the ovens nearest the fire are arranged differently in different ranges, some having an iron plate reaching from top to bottom, the upper part of the plate having a ledge for the fire-brick torest on; in other ranges this division must be huilt up in 4½-in. brickwork. The flues over the tops of the ovens are about 2½ in., and down the outer sides of the ovens are about 1½ in., but both these are controlled by the castings. The flues under the ovens are about 3 in. The sizes of the boiler and the cylinder depend on the requirements, also on the size of the fire. The cylinder system of apparatus is shown, but the tank system is sometimes preferable if the water supply is regular.

Coke Breeze Bricks.—Breeze bricks of the unbaked kind may be made of coke breeze and Portland cement, in the proportions of 2 parts breeze to 1 part cement, made in a mould and 1sft for seven or eight days to set. If baked, clay and coke breeze in equal proportions should be carefully mixed, placed in a mould, air dried, and then burnt in a kiln in the ordinary

Shampoo Stand.—The simplest shampoo stand is a very large wash-basin with marble top, or a basiu and top in one piece of earthenware, supported on a stand or on a bracket fixed to the wall. The basin should have a plugged and grated waste-outlet and an overflow arm. The waste-pipe should be trapped and fixed to discharge into a gulley-trap outside the shop. Hot and cold water should be supplied, the hot water from a tank with circulation pipes to a boiler, or from a heater. The shampoo-cock should be made so that the supplies of hot and cold water can be regulated. A short flexible hosepipe and rose or spreader should be attached to the cock. The whole of the fittings can be bought much cheaper than they can be made.

Plait Mill.—Figs. 1 and 2 show elevations of what is commonly known as a plait mill, used in rustic districts where straw plait is made, to roll or "mill" the straws to make them pliable. Beech is suitable for its construction, but the screw is boxwood. The handle and rollers may be prepared by a local turner, if the maker has not got a lathe. All joints must be painted with white-lead, redlead, and linseed oil paint, and all parts where friction occurs are blackleaded. The stiles A are 1½ ln. by 3 in.,



Plait Mill.

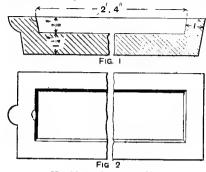
and are placed 5½ in. apart, and chamfered and rounded at the top and bottom. The front one is lft. 3in. long, and the back one, which is fixed to the wall, is lft. 7in. long. The rails B are tenoned into the stiles with lin. tenons (see Fig. 1) which project ½ in. in the front, the end being chamfered; they are fastened with hardwood negs, and the top one is tapped to receive the tightening screw C which presses on the cross piece D. This again slides in a slot E, lin. deep and lin. wide, and presses a hardwood block F which also slides in the slot, the bottom of the block being hollowed to suit the spindle of the top roller. There is a block on each side. The rollers G are of 3-in. sycamore with l-in. spindles; those of the top roller are lin. long, but the hottom one is carried out 2½ in. beyond the stile, and to it the handle is fixed, the end being left square. The sweep is l0 in. long, l1:in. by l2-in. stuff being used, and the handle is 6½ in. long, including tenon, and lin. by lin, in section. The sweep and handle are fastened by pegs.

Black Varnish for Iron Castings.—There is difficulty in obtaining or mixing preservative preparations for new iron castings, but the following may be used with advantage on all kinds of new castings, drain pipes, and ornamental ironwork exposed to atmospheric influences. Melt 12 gal. of coal tar in a copper or other suitable vessel heated to about 250° F., then sprinkle 3 lh. of coal-tar pitch and 2 lb. of resin, and stir continually until the latter is dissolved; then add 3 gal. of boiled linseed oil, stir well and pass through a strainer, when the composition is resdy for use. The addition of lime drives away or neutralises any free acid in the tar, which would eventually have a corrosive action on the iron. For heavy castings, a method often adopted is to place sufficient of the preparation in a suitable tank, which is heated to 200° F., and the castings are dipped into the tank by means of overhead travelling cranes or pulley blocks. Another method is to heat the castings slightly and dip them into the preparation which is cold. The hot

castings turn the varnish thin, and it readily enters the pores of the fron. The preparation in a few hours dries hard with a good gloss, which is tenacious and not brittle. It may be used cold and applied with a brush, provided a small quantity of coal-tar naphtha and lamplack is added, but it should on no account be heated after adding naphtha, which hastens the drying somewhat, whilst the lampblack gives it better covering properties. It then dries with a good gloss in about three hours, and may be found useful where a quick finish is required.

Bending Cycle Handle-bars.—A cycle handle-bar is cut with a hack saw or tube cutter, then loaded with caster's fine dry sand, and the ends are plugged up. Mark with chalk where the hend is required, or fix a stop on the bending block, heat to a dull red, and draw round a grooved bending block of the required shape. A bar could he altered in this way, made narrower, or turned up, etc., without the block. Heat in the right place, hold the end in a tube clamp bend one side as required, and then the other to correspond. The tube must be packed tight with sand otherwise it will buckle. Wheu bent cold, the tube is filled with pitch, or a flexible mandril is passed through, and drawn round a bending block.

Mould for Plate Spelter.—A mould made to the illus trations (Figs. 1 and 2) will probably answer for casting re-melted scrap zinc into cakes of spelter. Scrap spelter is generally smelted, with other material containing zinc as ore or refuse, in a reverberatory furnace in quantities of several tons at a time. The mould is of iron, flat, open-topped, with raised letters on the



Mould for Plate Spelter.

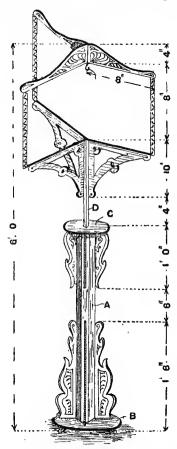
bottom, which are reproduced on the plate of spelter. The size of the mould varies, some plates being about 15 in. by 10 in. by 1\(\); in. thick, others of crown spelter being about 24 in. by 9 in. by \(\) in. thick. The thickness of the iron in the mould need not be more than 1\(\) in at the bottom by 1 in. at the sides. In the illustration the cup at the side is for pouring the metal. If the metal is quite clear and free from dross, it can be poured into the open ingots and give a good top surface. Great care is needed not to overheat the metal to the point of volatilisation.

Wax Solution for Glazing Prints.—In a waxing solution for use in glazing photographic prints the kind of wax used is not of much importance, hut white wax is generally employed; the quantities are also open to considerable variation. Shred up some white wax and dissolve it in a sufficient quantity of henzole or turpentine; wax logr., henzole loz., are good proportions. Moisten a flannel with the solution, rub the print evenly all over, and finish by polishing thoroughly with a dry cloth.

Bleaching and Blocking Panama Hat.—For bleaching a Panama grass hat, it first should be thoroughly washed by passing it several times through a hot soap solution, and then rinsed in hot soft water. Bleaching may best he performed by sulphurous acid as follows. Hang the damp hat by a cord high up inside a large box or harrel which should be placed, inverted, in the open air over a small heap, say loz., of powdered sulphur; set fire to the sulphur by means of a red-hot poker, and rest one edge of the hox or barrel on a brick so that air may reach the sulphur and keep it burning. After bleaching, the hat may be rinsed again in hot water to remove the excess of acid. Blocking should be done on blocks, but may he carried out by dipping the hat in a weak size made from white gelatine and, when nearly dry, ironing with a warm iron covered with linen on any support that may be handy.

Hardening Face of Steel Hammer.—To harden a cast-steel hammer so that the centre of the face will be as hard as the edges, heat the face to a cherry red, aid see that it is the same heat in the centre as at the edges. Then, when cooling the face in the water, keep moving it about until it is quite cold, brighten it up with a rub stone and let down to a deep straw colour.

Birdcage Support.—The accompanying illustration shows a useful and ornamental birdcage support. First, a length A of 4-in. quartering is required, and its edges should be planed off till the section is a perfect octagon. A disc of wood B, 10 in. in diameter, screwed on the bottom, with four small feet, forms the base. A disc C, 8 in. in diameter, is screwed on the top of the column, and a hole drilled through this and into the column to a total depth of 6 in. to admit the upright D of the top portion. On four sides of the column ornamental pieces, or fretwork, should be fastened, and the top triangular



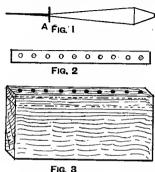
Birdcage Support.

portion is also made of carved wood or fretwork, supported on a triangular upright, the bottom of which is rounded to fit in the hole in the column, but not fastened. A hook E is screwed into a small triangular-shaped piece of wood to hang the birdcage on, and to which the three top pieces are fastened. The whole stand may be made in any of the usual cabinet woods, and it should be stained and varnished to match the furniture.

Artists' Oil and Water Colours.—To manufacture artists' oil colours from raw materials requires special knowledge and apparatus. The simplest and cheapest method is to obtain the colours in their pure state, dry, from a colour manufacturer and grind them under a pestle and mortar, a palette knife on a marble slab, or through a small handpower cone paint mill, using as a medium for the dark colours raw linseed oil, and for the light or delicate colours refined linseed or poppy oil, which would not

affect or change the delicate colours. In each case the pigments should be ground perfectly fine and free from grit, and a small sample thus ground should be rubbed out in an almost transparent layer on a piece of ordinary sheet glass, when the fineness of the pigment may easily be determined. The colours are then placed in collapsible tubes, which keep them in their paste state. The cost of the dry colour will vary according to the class of pigment required. For water colours, the pigments are obtained as above and ground in water in which a little gum arabic has been dissolved, about 1 oz. to 1 pt. of boiling water; they are then placed in wood or brass moulds of various dimensions, and dried in a warm atmosphere. Some makers place their water colours in a moist state in collapsible tubes, this method being much better than the block colours, as they are always moist, ready for use. The following is a list of colours usually found on an artist's palette board. For red: vermilion, carmine madder, light or venetlan red. For yellow: yellow ochre, lemon yellow, orange cadmium. For brown: burnt sienna, raw and burnt Turkey umbers, sepia, vandyke brown. For blue: cobalt, Prussian and ultramarine blues. For black: ivory hlack and lampblack. For white: flake white and zinc white. Comprehensive formulæ for mixing the various tints and colours will be found on p. 31.

Boring Holes in Birdcage and Aviary Construction.—Fig. I shows the kind of bit that is used for making the holes; the small round piece of metal A is soldered to the bit to prevent it penetrating into the wood too far and making the holes too large. Bands for birdcages are made as follows. The wood, which may



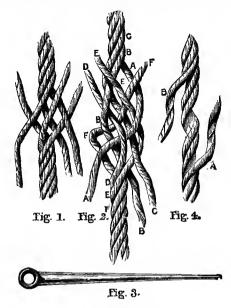
Wooden Bands for Birdcages and Aviaries.

be either mahogany or deal in. in thickness, is planed up, then a metal guide (Fig. 2) is tacked on the edge and the holes are drilled in the wood through the metal guide. This is then taken off and a band is cut off the wood, using an ordinary mortise gauge having the point knocked out and a small blade inserted. After cutting off the band, on examination it will be found that the bit has pierced the wood sufficiently far to mark the holes for the next band to be bored. Fig. 3 shows the wood with the first band bored, the dotted lines indicating where the cutting gauge will cut it off for the first and second bands. For a metal guide, procure from a case maker an inside metal band; this will have the holes punched in at the proper distances, and may be had almost any length.

Fixing Soles to Rubber Boots.—A cement that has been found very satisfactory for fixing soles to rubber boots is made as follows. Solution (1), chloroform 280 parts, masticated indiarubber 10 parts. Solution (2), indiarubber 10 parts, solution (2), indiarubber 10 parts, solution (2), parts, and oil of turpentine 40 parts. Dissolve solution (1) by mastication. For solution (2), melt the finely divided rubber in the resin, add the Venice turpentine, and finally the oil of turpentine; use heat if necessary. Mix the two solutions together finally. Saturate a piece of linen with the cement and apply to the part previously coated with the cement; as it dries apply more as required, and finally bring the two parts together. The following is a simple preparation for repairing rubber shoes. Pour 12 to 14 parts of carbon disulphide over 2 parts of rubber cut into small pieces; let the vessel containing the above stand in a water bath at 86° F. until the solution is effected. The solution is of a paste-like consistency, and to prevent it hardening too rapidly reduce it with a solution of rubber and colophony in oil of turpentine. To prepare this, melt at a moderate heat I part of rubber, and add to it it part of colophony; then add the required quantity of oil of turpentine and thoroughly incorporate.

Gilding Cardhoard Mounts.—For gilding the edges of cardhoard mounts a laying press, a steel scraper, and a burnisher are used. The cards are knocked up evenly, placed hetween gilding boards in the press, and screwed up very tight; the edges are then scraped smooth with the scraper. A preparation of Armenian hole and blacklead is theu brushed over the edges. When dry, they are treated with size composed of white of egg beaten up to which water is added—one egg to 1 pt. of water. The size is put on with a broad camel-hair brush. While still wet, the leaf gold is laid on and allowed to dry thoroughly, after which it is burnished.

Splicing Wire Rope.—Wire rope is spliced in one of two ways according to the illustrations below. The short splice is used when hulge or bunch is not of consequence in cases of moderate stress; the long splice ensures uniform diameter and no diminution of etrength. Hemp and wire ropes are spliced in the same way, except that in the latter the splice is longer. For making a short splice, unlay the three or six strands, as the case may he, for from 6 in. to 12 in., the actual distance depending



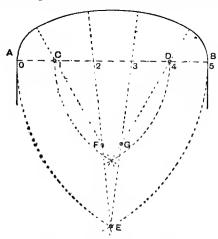
Splicing Wire Rope.

on the size of the rope and the required strength of the splice. Open out the strands and place them together in alternate positions, as shown in Fig. 1, this operation being known as "marrying" the ends. Pass each strand over and under the next strands, three, four, or six times in succession. Fig. 2 shows the interlacing of the opposed sets of strande once before the rope is pulled tant. The letters show the positions of the individual strands. Now grease the strands, make a way between them in the rope by thrusting in an iron marlinespike (Fig. 3), then pull the strands as tight as possible and roll the splice between boards or under foot so that the diameter may be increased as little as possible. For making the long splice, unlay the strands in the two rope ends for a considerable distance, and lay the one set of strands A (Fig. 4) in the groove left by unlaying B. When a sufficient length has been treated by unwinding and unlaying all the strands in succession, unite the ends by thrusting them through openings made by the marlinespike, as in ordinary splicing, and then the splice heing very long will be scarcely perceptible. The rope ends are held in their sockets by pins.

Paste for Wall-papers.—Elastic or pliable paste for wall-paper may he made as follows. Take 3 oz. of ordinary starch, 3 oz. of white dextrine, 22 fi. oz. of cold water, 2 oz. of borax, 6 oz. of glycerine, and 1 gal. of holing water. Mix the starch and dextrine with the cold water to a batter. In another vessel dissolve the horax in the boiling water, then add to it the glycerine; then add gradually to the starch while constantly stirring, when it will turn into a translucent paste. This paste will not crack, but is very pliable; and may be used with advantage where flexibility is required, as on expensive papers. Strong adhesive paste for heavy papers may be

prepared by mixing 81h. of rye flour into a batter free from lumps with 1 gal. of cold water; then add steadily 3 gal. of boiling water, constantly stirring; after which, ilb. of powdered resin should he gently sprinkled in, a little at a time. Should the paste become thick when cold, thin as required with hot water. This is a good paste, and may be used for hanging heavy wall-papers or leather. The following are the ingredients for the well-known Venetian paste. Fish glue Soz., cold water 16 oz., Venice turpentine 4 oz., rye flour 21h., boiling water 1 gal. Dissolve the glue in a glue pot with the cold water in a water hath or over a fire; then stir in the Venice turpentine. In another vessel dissolve or make a batter of the rye flour with 2 pt. of cold water, then add while constantly-stirring the hoiling water. The contents of the two vessels should now he stirred well together. This makes a paste that is very tenacious, and, owing to the Venice turpentine in its composition, will make the paper adhere firmly to any painted surface. Lincrusta-Walton may be hung with a paste made by dissolving with boiling water 11b. of best Scotch glue and adding to a paste made from 31h. of hest flour; apply it very thick, and in a warm room.

Setting Out Five-centred Arch.—The accompanying diagram shows how to get the radius points for a five-centred arch. Draw the spriuging line of the arch of the required span AB; divide this line into five equal parts, as numbered. With a radius equal to the span describe arcs intersecting at E, and from the intersection draw lines through each side of the central division. Then



Setting Out Five-centred Arch.

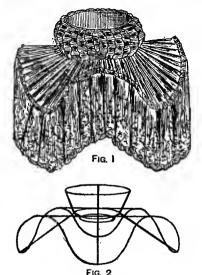
with a radius equal to three divisions draw arcs intersecting as shown, and from the intersection draw lines through the end of the next two divisions. The small circles show the centres for describing the five curves in the arch. Draw first from the centre C the curve at A up to the dotted line, then continue the curve from the centre F up to the next dotted line, and from E up to the next, theu from G to the next, and from D to the fluish.

Removing Gold Paint. — To remove gold paint, melt 3 parts of American potash and 1 part of unslaked lime in 10 parts of water. With this, paint the articles repeatedly hy means of an old paint-brush until the gold paint softens, then wash in hot water with a sponge. Another method is to rub the surface well with henzine and a little finely powdered pumicestone, and afterwards well wash with strong soda water. Care should be taken not to allow the first-named preparation to come in contact with the clothes or hands, as it is of a hurning nature.

Restoring Colour of Mackintosh.—In the case of a hlack mackintosh having turned a greenish hue, the original colour can be restored in the following way. Make two solutions. For one solution boil 402. of logwood chips with 1 pt. of water, strain, and make up to 1 pt. again, and add ahout 1 drachm of carhonate of ammonia. For the other solution, dissolve 202. of sulphate of iron and 402. of sulphate of copper in 1 pt. of water. Having both solutions warm, sponge the mackintosh first with the logwood solution, and when it is nearly dry spouge with the sulphate of iron solution. A second treatment with the logwood solution following the iron solution may render the mackintosh blacker.

Storing Varnish in Barrels.—Varnish when stored in barrels should never be moved about, for the following reason. After standing a few days there falls to the bottom of the barrel a sediment which consists chiefly of particles of manganese driers and refuse of the gum, known in the trade as varnish foots. When this has settled, if the barrel is disturbed by shaking this sediment mixes with the varnish and turns it streaky and unfit for high-class work, as the varnish when applied over white or any delicate tints clearly shows the faulty varnish by brushing up in dirty irregular patches. The idea prevalent among users of varnish that unless the sediment be mixed into the varnish it loses its drying properties is quite a mistake, as the sediment is simply the spent drying agents and refuse from the gums used in the manufacture of the varnish. This sediment can only be removed by allowing the varnish to repose or by passing it through a filter press. A method of removing the varnish from barrels is to place or screw a treacle tap ahout 2 in. from the bottom of the barrel, so that the varnish will run clear of the foots, then place on a stand and allow to repose some time before using. some time before using.

Lamp Shade.—Fig. 1 shows a lamp shade trimmed and Fig. 2 the frame. The stretchers will be 6; in long,



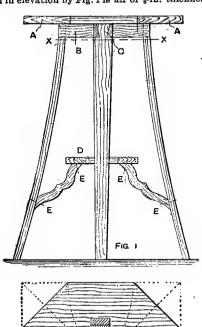
Lamp Shade.

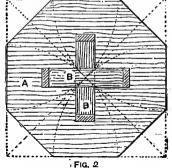
and the rim 5 ft. 4 iu. For trimming, 33 yds. of sateen silk, and the same quantity of lace, will be required.

Repairing Photograph Album.—For repairing or adding to albums it is not possible to buy papers already cut, as, owing to the many different sizes and positions of the openings, etc., it would be impossible to keep a stock. However, should the worker wish to cut the papers himself, the following hints may be useful. First procure some good white paper; a printing paper will be best, a useful size being demy, and of this about 24 lb. to the ream is a good quality. Cut up a number of sheets a little larger than the leaves of the album, and with one of the edges straight and smooth. Next make a template of sheet zinc of the size of the present openings in the album leaves; or if the openings are the ordinary cabinet or carte-de-visite sizes, procure glass cutting shapes from a dealer in photographic materials. Get also a large sheet of zinc or glass for cutting on. Take a sheet of paper and mark with a pencil the position of the opening, measuring with compasses from the back edge of the old paper and the top edge of the leaf, and making the marks on the new paper from the smooth edge already mentioned. Then place the template to the lines and, having the zinc or glass sheet below the paper, cut round the shape with a sharp knife. Go over the albumleaves and the samp shed to paper from the holes so as to expose the cardboard underneath, taking notice where the paper has been pasted to the board. After all has been made as smooth as possible, fasten on the new paper with flour paste of such consistency that it will work easily with a brush, pasting over the cardboard and taking care not to cover any part where paste had not been

formerly. Now lay on a sheet of paper with the house placing the smooth edge close to the joint at the back of the leaf; over this lay a sheet of waste paper, and rub over the whole surface with the hand to ensure the new covering sticking to the leaf. All the leaves are treated in the same manuer, and the album is closed up and put under a heavy weight or in a copying press until dry. The edges of the leaves must then be trimmed with edges of the leaves must then be trimmed with scissors or a sharp knife.

Octagonal Table.—The wood of the octagonal table shown in elevation by Fig. 1 is all of 4-in, thickness, the





Octagonal Table.

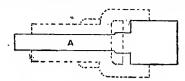
most suitable being oak or walnut. The top A (Figs. 1 and 2) is made from a piece 20 in. square, and the rails B. shown in plan in Fig. 2, which is a section on X X (Fig. 1), are ll in. long by 1½ in. broad, and are fastened together by a half-lap joint. On the ends of these rails dovetails C (Fig. 1) are cut, into which the legs fit. The top is held by screws, which go through the rails, and the octagonal tray D, which is cut from a piece 9 in. sq., should be placed about 12 in. from the bottom of the legs. It is held in position by screws E, which go through the two ends of each of the four supports or brackets. The edges of the top can be chamfered or rounded, or a moulding may be run on them, as desired. The four legs are 30 in. long by 2½ in. broad, tapering to 1½ in. The method of marking out the octagonal top is indicated by dotted lines in Fig. 2. The supports for the tray may be made \$in. long by 1½ in. broad, and the spread of the legs at the bottom may be 22 in.

Removing Mercury from Watch and Case.— Heat will drive off the mercury from the works and case of a silver watch, but cannot be applied to the movement without spoiling it. The movement will therefore have to remain as it is; no particular harm will be done. The case can be taken to pieces and the parts heated separately. It will then want well buffing with rottenstone and polishing with rouge.

Gream Paste for Calf Boots.—For a cream paste for calf box boots, procure 1 lb. of curd soap, 4% pt. of water, 2 lb. of beeswax, 2 lb. of oil of turpentine, and colour as desired. Cut up the soap and dissolve it in water by boiling; then dissolve the wax in the turpentine by heating the two together, and slowly pour this into the soap solution, briskly stirring the mixture until it is cool and creamy. The above can be made into any colour by placing aniline dyes in the water before adding the soap.

Repairing Cracked Oven,—The cracking of a castiron oven often is brought about by the oven being screwed up or fixed too tightly so that there is no give-and-take to the movements of expansion and contraction. All good ranges now have wrought-iron ovens. Covering the crack with a plate of iron bedded with putty, then screwing on, will make a lasting job. If the crack is not easily got at, then a sound, if not good-looking, job can be made by plastering over the crack or fissure some fire-resisting cement such as Purimachos cement. cement

Hardening Bushes for Mail Patent Axles.—
For hardening or chilling the inner face of a castiron bush for a mail patent axls, make the iron core or chill as shown by the accompanying sketch; do not make it exactly parallel, but slightly tspering, say \(\frac{1}{12} \) in in a foot. For forming the recess in the box that holds the oil, make a ring of sand to the size required, using a flat open core-box. Before



Hardening Bushes for Mail Patent Axles.

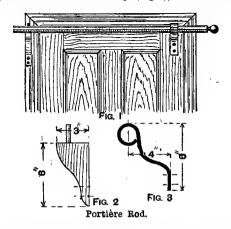
pntting the iron core A in the mould, coat the core with hot tar, then place the ring of sand in position as shown by the dotted lines; place it in the mould ready for casting the box. When the metal has been run into the mould, it will be found that the coat of tar gives a certain amount of clearance to the iron core, so that it can be driven out without the rick of breaking the asting.

Tinting Paints and Colours.—The following list is useful when preparing tints and colours. As there is no standardisation of colour, the following proportions are given as made from the finest quality of paints and colours; where cheaper qualities are mixed the quantities of the ingredients should be varied to suit, and many who prefer to mix their own particular shade or colour, or who do not care to stock a large assortment of colours, will find it easy to compound whatever shade they require from the following comprehensive formulæ. Whites: Pure white, equal parts white-lead and zinc white; translucent white, white-lead 1 part, barytes 10 parts; flake white, pure English white-lead; Cremnitz white, pure zinc oxide 100 parts, ultramarine 1 part; transparent white, oxide of zinc 1 part, barytes 20 parts; and clear white, white-lead 300 parts, ultramarine 1 part; transparent white, oxide of zinc 1 part, barytes 20 parts; and clear white, white-lead 300 parts, ultramarine 1 part; Ysllows: Primrose, pale zinc chrome; lemon, lemon chrome; buttercup, middle chrome; caulary, white-lead 6 parts, ochre 12 parts, middle chrome 3 parts; transparent yellow, yellow ochre 1 part, barytes 10 parts; golden ochre, yellow ochre 1 part, barytes 10 parts; golden ochre, yellow ochre 1 part, barytes 10 parts; golden ochre, yellow ochre 1 part, barytes 10 parts; golden ochre, yellow ochre 1 part, barytes 10 parts; golden ochre, yellow ochre 1 part, barytes 10 parts; light stone, white-lead 100 parts, yellow ochre 2 parts; dark stone, white-lead 100 parts, yellow ochre 12 parts; dark stone, white-lead 20 parts, yellow ochre 12 parts; dark stone, white-lead 20 parts, yellow ochre 12 parts; middle chrome 1 part; dark oak, white-lead 2 parts, wenetian red 1 part, light oak, white-lead 6 parts, venetian red 1 part, unber 3 parts; buff colour, white-lead 100 parts, yellow ochre 1 parts; raw umber 3 parts; ash colour, white-lead 100 parts, yellow ochre 1 parts, raw umber 3 parts; enome 1 parts, turkey umber 3 parts; each; leather colour,

colour, white-lead 100 parts, yellow ochre 4 parts, raw umber 4 parts, deep green 1 part; and limestone colour, white-lead 100 parts, yellow ochre 1 part, raw umber 1 part, Reds: Maroon, venetian red 2 parts, indian red 4 parts; leading and yellow ochre 2 parts, indian red 4 parts; light indian red, rose pink 2 parts, indian red 4 parts; light indian red, rose pink 2 parts, indian red 4 parts; light indian red, rose pink 2 parts, indian red 5 parts; leave 1 part; may red parts, indian red 5 parts, present of the parts of parts, indian red 5 parts, present lake 1 part; mave tiut, white-lead 6 parts, present lake 1 part; mave tiut, white-lead 60 parts, present lake 1 part; liac dart, white-lead 100 parts, ultramarine 3 parts, mader lake 1 part; liac dart, white-lead 100 parts, ultramarine 1 part, venetian red 1 part, burnt sienna, white-lead 2 parts, venetian red 1 part, burnt sienna, white-lead 2 parts, venetian red 1 part, burnt sienna, white-lead 2 parts, lead 40 parts, golden ochre 5 parts, venetian red 1 part, burnt sienna parts, white-lead 1 part; brick colour, venetian red 2 parts; mahogany, orange chrome 10 parts, burnt sienna 3 parts, white-lead 100 parts, consent, white-lead 10 parts, trisk colour, white-lead 5 parts, rose madder 1 part; light pink, white-lead 100 parts, rose madder 1 part; light pink, white-lead 100 parts, rose madder 1 parts; light pink, white-lead 100 parts, rose madder 1 parts, present of parts, rose madder 1 parts, parts, so the parts, so parts, light pink, white-lead 100 parts, parts, light pink, white-lead 100 parts, parts, light pink, white-lead 100 parts, parts, light parts, parts, light pink, white-lead 100 parts, parts, light parts, parts, light

Wax Moulds for Plaster Casts.—Wax moulds are made from equal parts of pure beeswax and powdered resin. With wax of very good quality the proportion of resin may be doubled. A poor wax will be improved by the addition of a little tallow. The mixture should be slowly melted over the fire, and allowed to become slightly cool before using. The safest way is to melt the wax and resin in the same manner as glue is melted, that is, by placing them in a jar or pot surrounded with boiling water. For taking a mould from a plaster original, the plaster is well saturated with water to prevent the wax sticking. When as much moisture as the plaster can contain has been absorbed, the surplus water on the surface of the plaster should be wiped off with a sponge, and the wax carefully poured over. The plaster need not be coated with shellac, but, if soaking in water is objected to, a coat of paraffin oil in which a little white wax or stearine has been melted can be applied.

Portière Rod.—In Series I., pp. 125 and 145, are two designs showing how to fix up a portière rod, and the following is a description of another portière rod device (Fig. 1). It works with the door, backwards and forwards as the door is opened or closed, and consists of a bracket (Fig. 2) cut out of mahogany I in. thick, 3 in. wide at the top, and 6 in. long, and screwed to the moulding on the door frame, hanging side. A piece of iron is bent to shape (Fig. 3), and is screwed



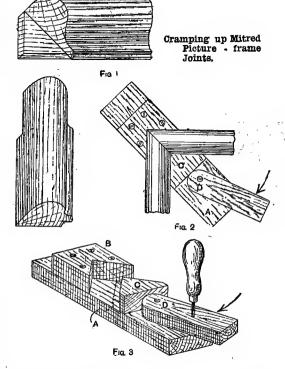
to the door 2 in. from the shutting stile. A rod of wood, bamboo, or iron is cut 3 in. longer than the distance between the outside of the mouldings, and a hole is bored with a red-hot nail in the case of the wood or bamboo, or drilled for iron at 1½ in. from one end. In it works a screw, with the head filed off; this screw is fastened in the top of the bracket. The curtain is hung on rings, the two end ones being fastened to the rod by wires going through or round the rod to prevent them falling off in working.

Holes in Plaster Cast.—These are caused by bad casting. Only a small quantity of gauged plaster should be poured into the mould to begin with, and this should be sufficiently liquid to be shaken or blown into the smallest markings. When filling up any of these air holes the spot should be soaked with water before applying the fresh plaster. If this is not done the cast will absorb the moisture from the newly applied plaster, preventing its proper setting and rendering it liable to crumble away.

Cycle Transfers.—The usual method of making transfers for cycles is by the lithographic process, and bronze powder is used. The design is drawn and put on the stone; sometimes a number of stones will be necessary to complete the design, as each colour must have a separate stone; when bronze enters into the design, this is printed first. The design is rolled over with varnish instead of ink, and an impression taken on paper which is dusted over with bronze. The bronze sticks to the varnished impression and the surplus is wiped off, leaving the impression as solid as if it had been done with gold leaf. The design may be finished with this one printing, or other colours may be added. If a large number of transfers are required, it is usual to print several on one sheet of paper at a time and cut them up afterwards with a shaped cutter, which is simply a steel punch taking the conformation of the design. These transfers are printed on a thin paper which is afterwards

coated with a special mucilage. A cover paper is also gummed over the printed sheet to protect the design. When applying the transfers to the cycles, the thin paper is damped and placed in position and rubbed geutly but firmly to ensure the transfer adhering. After this is dry the cover paper is damped, and if properly done it will slip or peel off, leaving the transfer in position on the article.

Cramping up Mitred Picture-frame Joints.—For cramping up a picture-frame which has halved and mitred joints (see Fig. 1) a simple apparatus is shown in plan and perspective by Figs. 2 and 3 respectively. Out out a piece of wood as B, taking care to have the angle as near a right angle as possible, and screw this to a base piece A. Prepare a piece of wood as C; for many cases it will be better for this to be rebated as shown by dotted lines in Fig. 3, so that it may fit into the rebate of the frame. Now take a third piece, which should be of hard



wood, and round one end as D. Make a hole in the centre of the round and insert a screw in the base piece. It will be noticed that when the frame is adjusted, and C and D are placed in position, as indicated by the arrow, the frame will hold two parts of the joint tightly together. To prevent D springing back, a bradawl should be inserted as shown in the illustration. By simply altering the position of the screw of D, the apparatus can be made to suit varying sizes of mouldings. After the glue in the joint has become hard, the joint may be further secured by a screw from the back.

Acid for Testing Alkali.—For determining the strength of alkali employed in starch manufacture decinormal sulphuric acid is used; it is shortly described as $\frac{N}{10}$ acid, and contains 49 grammes of real sulphuric acid in 1 litre; 1 c.c. of this acid = 0049 gramme sulphuric acid, and also = 004 gramme of caustic soda. To prepare the acid, 30 c.c. of the concentrated acid are diluted to 1 litre with distilled water, to form an approximately normal solution; a measured portion (say 10 c.c.) of this acid is precipitated by barium chloride, the barium sulphate produced is washed, collected, dried, ignited, and weighed, and from its weight the amount of sulphuric acid in the diluted acid can be calculated. The decinormal acid may then be made from this acid by diluting it until it is strictly normal, and then diluting this normal acid 1 in 10—that is, 1 part of acid to 9 parts of water.

Removing Lime Deposit from Iron Pipes.-There Removing Lime Deposit from Iron Pipes.—There is no practical way of removing lime deposit from iron pipes, and with holiers all that can be done is to open them and chip out the lime with a chisel. It has been stated that making the pipes red-hot and hammering them will loosen the scale, but to do this they must be taken out, and in the end new clean pipes would cost no more. There are "boiler fluids" sold which, when boiled up in the boilers and pipes, soften the deposit, but do not remove it; it must be scraped out. The only practical recourse is to put uew pipes in, and the larger they are the longer they will go without renewing.

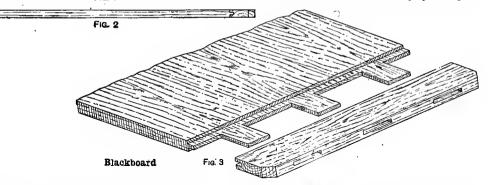
Blackboard.—Figs. 1 to 3 show the construction of a clamped blackboard. The material generally used is best pine, free from knote and with a close grain, the usual thickness in the rough being about 1 in., which works down when finished to about 1 in. The board would have to be formed by jointing up two, three, or more 11-in. boards, depending, of course, upon the particular size required. The best job results if these joints are ploughed and a cross tongue is inserted, all the joints being glued, of course. When the glue

FIG. I

but it should be as large as possible, as, unless a side-ways movement is given to the barrel, the tune is played in one revolution of the barrel. If two or more tunes are on one barrel, they should be about the same length, as the same mechanism that turns the barrel also works the bellows. There should be a small space unpinned so that the organ Is supplied with wind before any of the pipes are expected to sound. The barrels are made of 1-iu. pine, strips of which are joined together on a pair of octagonal ends, which may be made of well-seasoned mahogany, and on these ends the axles or pivots are fixed. The joints of the strips must be good and well glued, and the whole is then turned in a lathe to a true cylinder and covered with cartridge-or drawing-paper. If the barrel is put in place and made to turn round, the ends of the levers which come in contact with the pins can be made to trace lines round the barrel, giving the lines on which the pins will be placed. Suppose the tune has sixty-four bars of music, then the barrel will have its circumference divided into, say, sixty-six parts, on two of which there are no pins. Each bar will be divided into parts according to the music.

The best way to do this will be to set out on a band of paper 1 in. wide what may be called the time scheme of the tune; make the bars equal, and glue the ends together. Turn a disc of wood, mount the strip of paper on the edge, temporarily fix this on the barrel, and the time may be divided by moving the bars equal, and glue the ends together. Turn a disc of wood, mount the strip of paper on the edge, temporarily fix this on the barrel, and the time scheme of the tune; make the bars equal, and glue the ends together. Turn a disc of wood, mount the strip of paper on the edge, temporarily fix this on the barrel, and the time scheme of the tune; make the bars equal, and glue the ends together. Turn a disc of wood, mount the strip of paper on the edge, temporarily fix this on the barrel, and the time scheme of the midel part of which

motion can be made without injury to the pine.



becomes hard, prepare the clamps. These are usually about 3 in. wide. Then tenons and haunchings at each end of the board should be set out and made, after which the mortises in the clamps should be made and which the inverses ploughed to receive the haunching (see Fig. 3). Next glue the mortises and tenons and fix the clampe by wedging the mortises and tenons together, after which each surface should be planed off true and emooth.

Hardening Clock Pinions.—Clock pinions may be made of mild steel and case-hardened, preserving the bright surfaces by packing them in a box with the hardening material, and cooling without contact with the air. But this process will not ensure that they keep straight and true any more than making them of cast steel and hardening them in the ordinary way will. It is only constant practice that enables a workman to harden a pinion and keep it true, and nearly all pinions go a little out and have to be straightened by hammering. After hardening, each pinion requires trueing separately.

Barrel for Three-octave Street Organ.—The length of a harrel for a three-octave organ will depend on the number and spacing of the levers to be lifted. The length of the tune will suggest the circumference of the barrel,

Spongy Brass Castings.—Spongy castings are probably caused by lack of finish in the moulds. Make the moulds in the usual manner with the moulding sand well rammed down. A quantity of new red sand should, however, preferably be mixed with the ordinary sand because old sand does not hold together so well as new sand. See that the two faces of the mould (that is, the ene side and the peg side) are well dusted with facing sand, consisting of flour obarcoal mixed with oue-tenth its volume of fine sand, and also that the outside of the two faces are covered with parting sand so that the moulds may be placed together without fracture. This parting sand may cousist of powdered firebrick waste. When the moulds are ready they must be allowed to stand against the core stove to dry, otherwise blow-holes will be caused by the steam evolved when the hot metal comes in contact with the damp sand. Experience alone can enable the operator to decide when the metal is at the right heat for casting; as a matter of preference, the metal should be too hot rather than too cold, although too great a heat is undesirable. Cover the metal with a little flour charcoal. Half new morking alloy. If the furnace is pulling too fiercely the draught must be restricted, otherwise the metal will lose a considerable amount of its zinc, as this metal volatalises when heated much above its melting point.

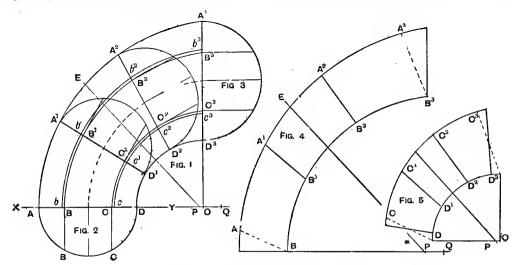
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Setting Out Pattern for Pipe Bend in Slx Pieces.—When working patterns for pipe bends to be made in six pieces, it should be understood that the methods adopted give only a very near approximation to absolute accuracy, as, owing to the amount of hammering the metal has to undergo, the stretching and tucking when hollowing vary with the quality of metal used, its thickness, and also the method adopted for working it. Commence by drawing the side elevation (Fig. 1) to the desired size, then draw the semicircles representing the half plans or sections of the base and mouth (Figs. 2 and 3). Next divide the throat curve (Fig. 1) into three equal parts, as D, D', etc., and also divide the outside curve A A's similarly. Join A'D' and A'D'. Find the centre of each of these lines and draw the semicircles shown, and it will be near enough for all practical purposes to assume that these semicircles are half the true shape of the section on their respective lines. Now divide each semicircle into three equal parts, and from each division point draw lines at right angles to each section line. To join each section line at the points BC, B'C', B'C', B'C', draw a curve through the points BC, B'C', B'C', B'C', draw a curve through the points just mentioned as shown, and the two curves formed would represent the seams on the side of the bend. Next bisect D'D' on the throat of the bend, and also A'A' on the outside curve similarly; draw a straight line through the division points found, and produce it to join the ground line at P. Work the

the curve being joined to B and B' respectively. For the throat pattern, reproduce the throat curve D D's to start the pattern (Fig. 5). Place the division points D', D' and also the ceutre point upon it, then work in precisely the same manner as for the pattern (Fig. 4), using the lengths from the elevation CC'C'C' to obtain the points on the outer curve. Then join CD and C'D'. In this pattern the throat curve would be lengthened, and the outer curve slightly diminished in length in the working, and allowance is made for this at each end of the pattern by the line drawn as shown.

Harness Dressing.—The following is a recipe for a black dressing for harness, to be applied with a sponge. Mix together molasses 8 parts, lampblack 1 part, sweet oil 1 part, gum arabic 1 part, isinglass 1 part, and water 32 parts, all by weight. When cold, add 1 oz. of spirit of wine. If the preparation is hard when being used, place the vessel containing it in hot water to get thoroughly warm. In warm weather this is not necessary. Add 1 pt. of turpentine after all the other ingredients are well mixed, but before putting in the spirit of wine.

Removing Paint and Varnish.—The following are for removing old paint and varnish. (1) Dissolve 31b. of caustic soda in ½gal. of water, then stir into it 21b. of



Setting Out Pattern for Pipe Bend in Six Pieces.

pattern for the centre piece BC, B°C³ first, and to do this divide one-third of each semicircle into four equal parts. Take two divisions from the small semicircle at the base, and set these off on each side of the centre line of the base (Fig. 1) to give the points, bc; take divisions from the semicircles at A, A², A³, A³, and set off similarly to give the points b¹ b² b³, c¹ c² c³; curves drawn through these points would be the side pattern. To draw the top pattern (Fig. 4), first reproduce the curve Be with the division points B¹ B² in position upon it, take the distance Q F from the ground line (Fig. 1) and set off from Q (the centre of the lower curve, Fig. 4) as Q P (Fig. 4). Bisect the distance B¹ B² (Fig. 4), and a line drawn from P through this division point would be one drawn at the same angle on the pattern as the line drawn from P on the elevation. Take a length slightly less than b² c² (Fig. 1) and set off from the curve on the centre line of the pattern (Fig. 4) to give the point E; take B¹ from the elevation and set it off on each side of E, then with the length b¹ c¹ from the elevation, and B² on the pattern as centre, cut the arc first drawn to give the point A¹. Take b² c² from the elevation as radius, and with A² on the pattern as centre draw an arc; with b³ c³ from the elevation as radius and B³ on the pattern as centre, cut the arc drawn to give the point A³. Transfer A¹ A to the lower end of the pattern similarly, using b c from the elevation as radius, and B ou the pattern as centre, to obtain the point A. Join AB and A³ B³, and draw an arc through AA¹ A² A³ to form the pattern. When hollowing this pattern the outer curve would shrink in length, and allowance is made for this by the length beyond the points A and A³, the point marking the allowance on

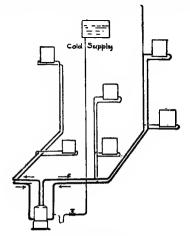
quicklime. Sufficient silicate of soda or waterglass' should now be added to form a paste. (2) Dissolve in an earthenware jar equal parts of soda crystals and quicklime in water, then add sufficient flour to form a paste. (3) Mix together in a stone bottle equal parts of spirit of wine and turpentine, then add a small quantity of carbonate of potash and stir well. Rub the varnish by meaus of an old piece of rag, afterwards washing down with soapy water. Finally, rinse down with cold water. The two first-named preparations should be rubbed over the work by means of an old paint-brush, and allowed to remain until the paint softens, when it may easily be removed by means of a knife, or hy scrubbing with cold water. These preparations burn; they should not be touched with the hands.

Colouring Tiles.—For colouring brown roofing tiles a permanent dark grey the following preparation is found to make an excellent covering; it is not affected by atmospheric influences, and is quite waterproof when hard. Dissolve 91b. of casein and 21b. of borax in 2 gal. of boiling water, then stir in 41b. of newly slaked lime, afterwards adding sufficient finely powdered whiting to form a wash or paint. The wash or paint should then be tinted to the required shade of grey by adding in variable proportions lime blue, lamphlack, and umber. Apply two coats with a whitewash or distemper brush. A little boiled oil may be added to make the wash adhere more firmly. Even in exposed places this wash will last for a considerable time. A cheaper wash, but not such a reliable one, is made by mixing any quantity of glue size and water, and add to it 4 parts of slaked lime and 6 parts Portland cement. Colour in the manner already described, and add a little boiled oil.

Solvent for Gelatine.—To dissolve gelatine in a fluid that will evaporate quickly, use the following method. Place loz. of gelatine in a wide-mouthed bottle, add 2 oz. of water, and place aside for twenty-four hours, when the water will be absorbed and the gelatine will have swollen up. Place the bottle in a pan containing a little cold water, and heat up gradually to boiling point; when the gelatine is hot, remove the bottle, and add methylated spirit very gradually, stirring well in. The methylated spirit should be added very carefully, as too much of it will precipitate the glue and render it stringy and tough. The mixture may be made more fluid, if desired, by first adding water and afterwards spirit, keeping to the proportions found best in the first trial.

Hardening Glycerine.—Glycerine may be hardened by mixing it with its own volume of water and then making it into a paste with plaster of Paris. It is also stated that glycerine may be hardened by mixing it to a paste with litharge.

Hot-water System.—Among the hot-water systems of heating bnildings are the one-pipe, two-pipe, and overhead systems, and there are modifications of each of these systems. The high-pressure system is another method, but in this case a coil is fixed in the furnace and a boiler is not used. The accompanying illustration shows a typical two-pipe low pressure apparatus in which the



Hot-water System.

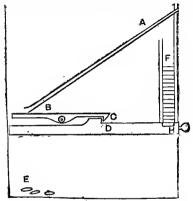
heat is distributed by radiators. In certain buildings large pipes are used as a heat radiating surface. With the apparatus here shown, one or more flow pipes proceed from the top of the boiler and take a convenient course to reach the radiators, having a gentle rise all the way. The return pipes are usually run close beneath the flow pipes, as shown. The radiators are on branches from the two pipes, as indicated. The circulatory movement of the water is in the direction of the arrows. From one of the high points of the apparatus a steam pipe is taken, terminating at some point above the level of the cold-water cistern. The cold supply is a pipe coming direct from a cold cistern down to the boiler, either entering the boiler at a low-point or joining a return pipe close to the hoiler. The cold cistern may be that which supplies the whole building with water; but should the highest radiator be two or three floors below this cistern, then a convenient and desirable arrangement may be the placing of a small intermediate cistern just above the level of the highest radiator, and feeding from that cistern. Sometimes the intermediate cisterns are hand-fed, sometimes they have water laid on, with a ball valve.

Preparing Brickwork for Signwriting.—Any amall defects or cavities in the brickwork should be filled with the oil cement described below, which dries hard like flint in a few hours, and will not crack or fall from the walls. Mix together into a paste with boiled oil 7 lb. of clean sharp sand, 2 lb. of slaked lime, 2 lb. of litharge (powdered); rub the holes with raw oil and use the paste as a mortar. After the paste has thoroughly hardened, apply a coat of raw oil over the wall that is to be painted, rubhing well into the brickwork until all suction is stopped; then apply a coat of genuine white-lead mixed with equal parts of raw and boiled oil and turpentine l part, with a little patent driers; a little black paint may be added if the ground

coat is to be of a dark colour. The work may then proceed in the usual manner. That the priming coats should be built up and prepared from the best materials and with the utmost care is a matter of great importance, for on this careful preparation the durability of the subsequent coats of paint depends. The walls should be perfectly dry before the work is commenced, and each coat of paint should be allowed to dry hard before the next coat is applied.

Cement for Felt and Cork.—For fixing a felt and cork covering with a cement that is pllable and can withstand reasonable heat and dampness, shoemakers' paste can be used, or a thick flour paste (as used by paperhangers for hanging heavy papers) to which has been added one-third its bulk of freshly made glue, may also be used. The following recipe can also be recommended. Clear gum arabic 8 oz., time starch 6 oz., white sugar 4 oz.; pulverise and dissolve the gum in 1) pt. water, mix the starch and sugar in the gum solution, then boil the whole in a vessel enspended in boiling water (glue-pot fashion), stirring and cooking till the mixture becomes clear and of the consistency of thick gum. A lump of camphor or a few drops of oil of cloves may be added to serve as a preservative and also to impart a pleasant odour.

Penny-in-the-slot Sweetmeat Machine.—The illustration shows one of the simplest penny-in-the-slot arrangements in use. The sweets are stored at F; a hollow H in the drawer D enables the bottom packet to be drawn out. The drawer is locked by the catch C on the



Penny-in-the-slot Sweetmeat Machine.

trigger B. To unlock the drawer, a coin is passed down the shute A, and, its weight resting on the trigger B, lifts it. The drawer can then be pulled out. This allows the trigger B to fall still farther, and the coin drops into the till E. The shute A should be made to take the coin exactly, and the trigger B to require the exact weight of the coin to release the drawer. This makes fraud more difficult.

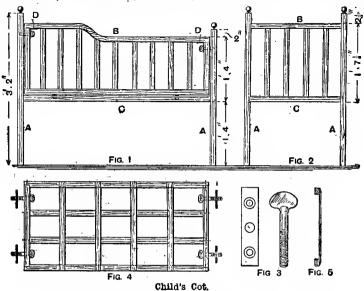
Photographic Carbon Transparencies.— The carbon process is certainly the most beautiful of all methods of photographic printing. The objection to the single transfer process is that the image is reversed. This is of little account with many outdoor scenes, and still less in the case of a transparency that may be viewed from either side, such as when the views on glass are to form panels in a window. The colour chosen for a picture is a matter for individual taste, but a warm sepia is very good. To make the transparency, coat the glass with a 10 per cent. solution of gelatine and immerse in the bichromate bath (a 3 per cent. solution of potassium bichromate); dry, and expose to the light freely. Expose the carbon tissue under the negative (which must be safe edged) for the time indicated by the guide negative or by an actinometer. Now immerse glass and tissue in cold water until the tissue straightens itself, then bring both films in contact under water, remove, adjust in position on the glass, and stroke into close contact with a flat rubber squeegee. When partially dry, place in warm water, and as soon as the gelatine commences to ooze out at the edges, strip off the first paper, leaving the bulk of the tissue on the glass. Lave with the warm water until the correct density has been obtained, then rinse and immerse for a few minutes in a saturated solution of alum, and finally wash for half an hour. A specially heavy tissue is made for transparencies, and this should be printed rather deeper than usual.

Tar for Wood Outbulldings.—Coal tar gives far better results on wood than Stockholm tar, as it dries harder and is more durable if mixed properly. The following makes a good tar varnish, and is an excellent preservative for wood. Coal-tar pitch 3lb., coal tar ½lb., beiled oil ½lb., coal-tar naphtha 1½gal., and paraffin oil 1½gal. Melt the pitch, then mix in the tar and oil; remove the mixture well away from fire, and allow to cool somewhat. theu add, while constantly stirring, the paraffin oil, following with the naphtha. This preparation dries hard and glossy in about six hours, and costs ouly a trifling sum per gallon.

Child's Cot.—Figs. 1 and 2 illustrate a simple and inexpensive cot 4ft. 2 in. long and 2ft. 1 in. wide; it may be made of ordinary pine or, if preferred, in hard wood. The four corner posts A are 1\(\frac{1}{2}\) in. square, all the top rails B are 1\(\frac{1}{2}\) in. wide by \(\frac{1}{2}\) in, thick, and the bottom rails C are 1\(\frac{1}{2}\) in. square. The ends, sides, and bottom are made separate for convenience when not in use. The side rests on the bottom, two screws being put underneath and holes bored in the bottom for them. Then the screw plates (Fig. 3) are let in the corner pillars in the top corners, and the whole, when screwed up, is very

foot or pad of cotton-wool. The brilliancy of the gold is increased if hot water is poured over it, the water burnishing it as it flows. Places where the gold is to remain must be carefully gone over with a writer's peucil, and any colour mixed with varnish and japanner's gold size of a consistency that can be easily worked. When the work has attained sufficient hardness it can be trimmed up with the point of a penkuife, guided by the edge of a lath or straightedge, the whole carefully cleaned with water, and the background painted any colour that may be desired.

Soling and Heeling Riveted Boots.—Riveted boots to be repaired should first be put into a flat vessel of water for about fifteen minutes, in such a manner that the water does not reach the uppers. On taking out at the expiration of this time, do not immediately remove the old leather from the under leather, but allow the boots to dry slightly. When judged ready for removal, place the boots on an iron last and prise up the old leather, commencing at the toe, with a small chisel; the portion thus separated can then be seized with a pair of pincers and peeled gradually away, care being taken to press down the



firm. All the nprights are \(\frac{1}{2} \) in. wide by \(\frac{1}{2} \) in. thick. Fig. 4 illustrates the bottom. The outside framing is l\(\frac{1}{2} \) in. by \(\frac{1}{2} \) in., and the laths are \(\frac{1}{2} \) in. by \(\frac{1}{2} \) in. the two long ones are stump-tenoned into the outside frame and screwed through. The others are lapped into the top of the frame. Fig. 5 shows the method of fixing the upright. The bottom is fixed with four of the screws and plates (Fig. 3), which are tapped \(\frac{1}{2} \) in. When finished, give the cot two or three coats of paint (French grey looks well), screw four brass knobs on the posts, and castors on the bottoms if desired.

Gilding on Glass.—In writing on glass, the first consideration is that the glass must be cleaned thoroughly from all grease and dirt, and then polished with a little French chalk or whiting. Whatever design is to go upon the glass must be reversed, as the gilding is done upon the back of the glass. The size is made from a small quantity of isinglass dissolved in boiling water, carefully strained, and a little spirit of wine added to it. It is impossible to give the quantity of isinglass required, but when made it is well to try the size upon a piece of glass. If it works sluggishly or does not look clear, it is coo strong, and should be weakened by the addition of water. If too weak, it does not bind the gold sufficiently to the glass, and the brush passing over the gold to fix it will partly destroy the effect. The size is flowed on the glass from a wide sable or camel-hair brush, and the gold is placed on the fluid size. It must be laid with a gilder's tip and cushion, and cannot be worked directly from the book, as it is done on japan size. When the size has dried, the glass may be lifted up and the face carefully looked over, and if the gold has not covered all the letters or ornament, the weak places must be gone over lightly with the size, and gold laid on where necessary. When dry, the gold may be rubbed over with a hare's

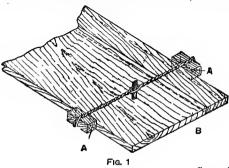
under leather with one hand, while pulling the remains of the outer with the other, to prevent the entire sole being pulled away from the uppers. In some cases it is next to impossible to prevent some parts of the under leather being pulled loose; securely rivet these before proceeding. Clear the under sole of loose nails, etc., placing small patches over any holes or much worn portious, these being held in position by the new leather sole. The new leather must first be soaked in water, afterwards dried, and beaten evenly on a flat iron with a hammer. When thoroughly dry, and made supple by the beating, cut the leather roughly to the shape of the boot and attach it to the under leather with four rivets, one on each side, one near the toe, and one under the ball of the foot. Pare away the leather towards the waist of the boot with a sharp knife, or the leather may be filed down with a coarse rasp. Mark out a line round the sole, about \$i\$ in from the edge, to show where the line of rivets should run, make the holes with a pointed awl, and rivet the sole securely. Pare away the rough edge of the new sole, leaving as broad a weltas may be desired. Now rasp all over the completed sole to get an even surface, working from the waist towards the toe; afterwards sandpaper to obtain a smooth surface. Heel-ball must be rubbed round the edges to blacken them, and these smoothed out with a warm iron. A gloss to finish is obtained by rubbing from toe to waist with a cloth over the thumb. The heel is renewed in exactly the same manner as the sole, the rasping being done from the waist outwards. The tools required are an iron last, an awl, a shoe-maker's knife, hammer, rasp, and glazing iron, the whole costing some few shillings. The leather for a pair of soles and heels costs from ninepence, this being the best leather, of English tannage; and \$\frac{1}{2}\$ in rivets, brass for the sole, iron for the heel, cost about one penny.

Caeting Metal Bust.—Obtain a brass mould of the bust desired in two parts; let these be smooth and well finished. Before casting, the moulds must be heated nearly to the temperature of the metal being used. Well black the two parts of the mould with a mixture of lampblack and turpentine, and fix together. Run the melted alloy into the mould till it is nearly full, and when a sufficient thickness of metal has solidified, rapidly turn the mould over and allow the still liquid metal to run out. The inside of the mould may be burnished to remove roughnesses if desired. On taking the mould apart the figure will be found smooth and fine in detail. The best alloy to use consists of about 91 parts of tin to 9 parts of antimony. After a little practice these castings can be turned out rapidly. If necessary (which will easily be seen after casting a few busts) add to the alloy a little bismuth, not exceeding 1 per cent. This increases the fluidity of the metal. The busts can be finished under the polishing bob.

Cramping up Boards.—Fig. lillustrates a satisfactory method of cramping up glued and jointed boards by means of rope and blocks. The wood blocks A, about 4in. long and lin. square, are placed on the edges of the boards B, and a rops is passed round them twice and knotted. A small piece of wood is then placed between the two strauds of rope and twisted round. This twisting draws the rope tighter on the blocks, thereby cramping the boards together. Three of these sets would be sufficient to cramp the boards. A more serviceable cramp is illustrated by Fig. 2. A piece of wood A, about 2ft. 9in. long, 6in. wide, by lin. thick, is planed up. On each end of this are fixed blocks B, 6in. long,

poppet centre of the lathe, the latter being reversed for winding. The fastening ring being shrunk in position, the end of the wire is pulled from the drum, and passed through a pair of hardened steel dies. The tension on these is regulated by a hand wheel and screw arrangement. One inch of the wire is next bent edgewise at an angle of 45°, pushed into the first recess, and secured. After this, the lathe is set in motion, the saddle and wiring arrangement travelling in the same distance as the breadth of the wire at each revolution. The wire is wound on until it reaches one of the numerous shoulders on the tube; the lathe is then stopped, and a short piece of packing wire pushed between the shoulder and on a level with the preceding wire; this has the effect of neatly raising the wire for the return journey. The leading screw is reversed and the lathe set in motion again. The same action is repeated at each shoulder until the wire comes level with the second recess, when it is clipped tightly to prevent it unwinding, cut and bent as at the commencement, and finally secured by a set-screw in a pocket. Other rings are shrunk over the wire and filled in the same manner as the foregoing, until completed, when a light cut is taken over the whôle surface with a spring tool.

Enamelling Slate.—Slate enamelling is done in various ways, each manufacturer having a particular method of applying the colouring matter and stoving. The following is a method which gives very good results. The slate used is known as hard blue Weish slate, which is first cut into lengths by a steam-driven saw, and then rubbed or flatted down with pumice and water, until a perfectly level and smooth surface is obtained. It is



Boards.

Cramping up Boards.

lin. thick, and tapering in width from 4 in. to 2 in. The boards E to be cramped are placed on the appliance, pieces D are laid against the edges of the boards to protect them, and the wedges C are then driven home. These wedges should be about 10 in. long, 1 in. thick, and tapering in width from 4 in. to 1\frac{1}{2} in. The whole of this device should be made of hardwood, except the packing pieces D, which should be deal, so that if too much pressure is applied to the wedges any injury to the edges will be taken by the packing pieces rather than by the boards.

Wire-winding 12-in. Naval Gun.—It has been found that 126 miles, or 14 tons 15 cwt., is the amount of wire wound on a 12-in. naval gun. With regard to wire winding, gunmakers contend that when the explosion—consequent on firing a shell—occurs in the powder chamber, the tubes are allowed to expand sufficiently without bursting; further, a higher velocity and greater range can be obtained. The steel wire used is hardened and tempered and very accurately drawn, its section being 66 in. by 25 in. For splicing the wire a couple of hanks, each weighing about 2 cwt., are taken. One end of each is placed in a milling machine, the table rest of which is tilted to give a taper of '06 in. in 12 in.; thus the wire is tapered to the thickness of fine tissue paper. After being milled the ends are reversed, placed together, and soldered ready for drilling. Twenty-six holes ½ in. in diameter are drilled between the two ends, after which steel rivets are driven in, and the wire is drawfled to thickness and breadth gauges. A ton of wire is thus jointed and is wound on to an iron drum, which revolves between a pair of pedestals on the lathe saddle. The wire fasteners, or steel rings, vary in thickness and diameter, and are shrunk in position on the gun tube. Two recesses are got out on the face opposite the breach end; the first one is on a level with the tube, where the wire is secured previous to winding by a secrew. The second is near the outside diameter and has a downward tendency to give a short depth-to the fastening screw. The breach end of the tube is secured in a thimble chuck, and the muzzle end run on the

then rinsed with cold water and placed in the stove to dry, after which it is allowed to cool, when it is given a coat of specially prepared enameller's black tar varnish, placed in the stove, and heated to 200° F, for from twelve to twenty hours. It is again taken out and rubbed down as before, until a perfect even dead surface is obtained, this process being repeated several times at some works according to the quality and thickness of enamel required. The slate should next be well dried and carefully examined for defects, as cracks, unevenness, etc., after which it should be given a coat of specially prepared enamel varnish and again stoved to 240° F. for several hours, when it is removed and polished by means of very soft woollen cloths and rottenstone. In some works it is finished by rubbing briskly with the palms of the hands, girls being generally employed for this purpose. The ornamental work, as lettering and scrolling, is done by experienced masons, using specially prepared chisels, gouges, etc. After the enamelling and polishing are completed gold leaf is applied, if necessary, in the ordinary way. Some manufacturers varnish over the gold leaf, but this is not recommended, as the varnish is found to go off dull after a few months' exposure to the atmosphere.

Cleaning Oil Drums.—To clean drums in which boiled

Cleaning Oil Drums.—To clean drums in which boiled oil has been stored, place in each \(\frac{1}{2} \) lb. of caustic soda, and fill up with cold water. Place them over a suitable fire and boil until the oil leaves the sides and bottom of the drums. Obtain a piece of iron or steel about 3ft. long, lin. wide, and \(\frac{1}{2} \) in. thick, sharpened at one end similar to a wood chisel; with this continually scrape the sides and bottom of the drum until all the loose oil and skin are removed. The drums should then be emptied and well rinsed with cold water to remove all traces of the soda, and then placed upside down to drain, after which they are ready for use. To reduce the cost somewhat, the soda solution may be repeatedly used until it becomes too thick or dirty with the oil. Steam may also be used instead of boiling over the fire; this method is adopted by oil manufacturers and others on an extensive scale.

Inlay Designs for Sideboard Doors.—The accompanying designs (see Figs. 1 and 4) are suitable for solid inlay, Fig. 1 being a sunk panel moulded door with vase design for inlay; this would look well in satinwood and mahogany, or holly and walnut. The edges of the inlay should be shaded by dipping in a tray of hot sand. Draw the design on stout white paper and paste it on the veneer; when dry, cut around the lines with a marqueterie-cutter's knife or a thin sharp penknife. Cut from outside to the centre, doing all the cross grain first, keep the knife wet. After the design is cut out, pin it to the panel and carefully draw in the outline with a sharp hard pencil, having first well chalked the panel. Cut around the outline with sendl chisels and gouges, and clear out the core with a sharp bradawl. Fill the sinking with glue, and rub in the inlay with a hammer face.

then cut in the banding just so tight that it arches about ½ in. Glue in the corners first, then glue a groove and the under side of the banding. Put one end in place and ruh a hammer face along until the whole length is in place. Should it spring, hand-screw a piece of greased wood on the top, and do not remove the pressure until the glue is found to be hard and dry.

Jointing Manhole of Range Boiler.—The best way of jointing the manhole of a high-pressure range boiler probably is to employ an indiarubber collar. Suitable collars can be purchased ready made in all sizes. These collars are clean to use, quick, and need no preparation. There are no such failures as occur with an unevenly made red-lead joint, and any slight leakage can be made good by tightening the nut. There is, however, one fault with

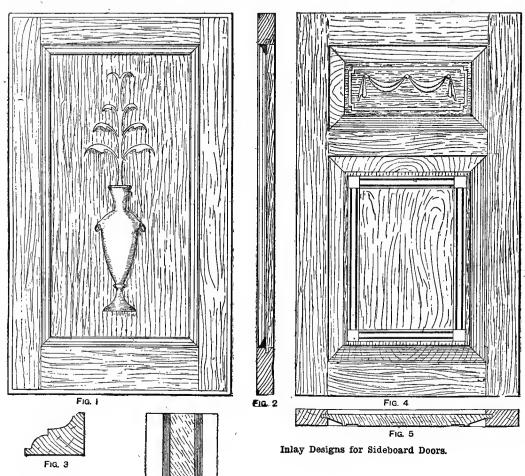


Fig. 2 is a vertical section of Fig. 1, and shows an eage band of inlay. Fig. 3 is a full-size section of the moulding. Fig. 4 shows the door with two panels, the upper one having festoons and strap inlay, the lower panel having striped banding. Fig. 6 is a full-size elevation of the banding; this may be purchased ready made in two or three woods and colours: the whites in satinwood, the blacks in blue, and the panel in dark mahogany would be effective. The panel is raised, with a sunk chamfer, which might also be veneered with satinwood. To prepare the panel for the inlay, set a cutting-gauge to the interior and also to the exterior lines of the inlay, and run the gauge all round the panel hefore chamfering. This will mark the grooves, which should be of such size that the banding will go in easily with slight pressure. The grooves and gauge lines must of course be stopped at the returns. The core may be removed either by chopping out with a chisel or, better, by running a quirk router through the sinkings, as shown in the section, Fig. 5. Cut the corner squares in first,

the rubber joint: the rubber softens when first heated and requires tightening up again, so that after the joint is made the water must be run in and the fire lighted hefore the workman leaves the job. If rubber is not used, recourse must he had to red- and white-lead and hemp. A putty is first made by mixing moist white-lead and dry red-lead to the consistency of ordinary glazier's putty. A little of this is thinned with holled oil to make a thick paint, and kept separately. With this the surfaces of the holler and lid, where the joint comes, are first painted. The putty, with strands of hemp hedded in it, is then put on the life, and when the latter is in position and tightened up, a sound joint is the result. Some workers prefer to chop the hemp up and thoroughly mix it in with the putty. A plece of the mixture is then taken and rolled into a rope shape with the hands. It is coiled on the edge of the lid, and then put on the boiler and tightened up. Another way is to the coiled hemp.

Fixing Green Baize to Drawer.—Assuming that it is required to line the bottom of a drawer interior with green baize, proceed as follows. Prepare some strong thick paste by boiling a mixture of flour and water, with a little powdered resin added; or procure some bookinders' paste, which contains dextrine and is very adhesive. Cut the baize slightly smaller than the drawer bottom, leaving a margin of about \(\frac{1}{2} \) in. all round. Now lay the baize smooth side up (if a very rough baize is employed, its surface should be sponged with hot water and rolled flat with a ruler or any other cylindrical object that is handy) and spread the paste over the surface with a sponge; draw the sponge from one side of the baize to the other in straight and continuous strokes all in one direction until the whole surface is covered. Just enough paste should be left on to lay all the fibres, but not sufficient to soak through to the other side, or a stain will result. Next, with hot water, lightly sponge the drawer bottom and rub over it al little paste; lift the baize up by the two opposite edges, folding the dry surface inwards, lower the loop on to the middle of the bottom of the drawer, and spread the baize out flat in each direction with the hand. When the baize is arranged in position, with the roller roll out from the middle towards the edges, using a piece of rag to pick up the paste that is squeezed out. Then press in with the thumb a tintack at each corner to help in keeping the baize down whilst the paste is drying. The baize should not be touched until dry, which may take from one to three days, according to the weather. Thin glue applied very hot may also be used in like manner, and will dry quicker, but is much more difficult to manage.

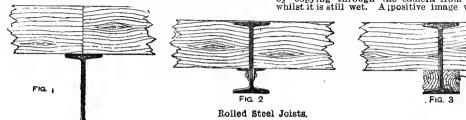
Strength of Rolled Steel Joists.—The strength of rolled steel joists is not affected by the mode of fixing the common joists. Fig. 1 shows the simplest method

sand, and have the joints pointed with cement morrar.

Furniture Cream.—Recipes for white furniture cream are given below. (a) White wax 3 oz., pearlash 2 oz., water 6 oz.; boil together, then add boiled oil 4 oz., turpentine 5 oz. (b) Rainwater 1 gal., yellow soap 4 oz., white wax 16 oz.; boil together, then add pearlash 2 oz. (c) Turpentine 3 pt., castile soap 12 oz., white wax 12 oz., butter of antimony 4 oz., vinegar 1 gill. 12oz., butter of antimony 4oz., vinegar 1 gill.

Photographing direct upon Bromide Paper.—A picture may be photographed direct on to bromide paper, thus dispensing with a negative, by using rapid paper, giving about twenty times the exposure needed for an ordinary dry plate, and developing with metol and hydroquinone. Use the developer somewhat stronger than is required for a plate, and with one-fourth the amount of bromide required for ordinary bromide work. The result will, of course, he a negative. The writer knows of no practical method of producing a direct positive in this way. The paper prints that are so rapidly produced by some photographers are obtained by copying through the camera from the negative whilst it is still wet. A positive image will result by

material but made of limestone only (no broken bricks) broken to a gauge of not larger than \(\frac{1}{2} \) in. This finishing cost should be rolled and re-rolled until firm and smooth. A concrete path can be made by excavating to a depth of \(\frac{1}{2} \) in. Fill in \(\frac{3}{2} \) in. of this with a rough quality of concrete, made by mixing one bag of Portland cement with two barrow-loads of sand and five barrow-loads of broken bricks or stone. With the flat side of a spade beat the concrete down and allow it to set. The finishing coat, about \(\frac{1}{2} \) in. or \(\frac{1}{2} \) in. thick, should be composed of equal parts of Portland cement and clean, sharp sand, laid on carefully and smoothed with a plasterer's float. A very excellent path can be made of concrete flags, which can be bought ready-made, 2in. and 2\(\frac{1}{2} \) in. thick and 1\(\frac{1}{2} \) in. square. These should be laid on a bed of cinders and sand, and have the joints pointed with cement mortar.



of fixing them, but this method occupies valuable space by increasing the total depth; Fig. 2 is satisfactory, but expensive; Fig. 3 is the method commonly adopted, and is on all points the most economical.

Vignetting Bromide Enlargements.-For vignetting bromide enlargements.—For vignetting bromide enlargements cut a card as coording to the shape of the required vignette. If the negative is thinner on one side than on the other, and an even vignette is desired, the opening must not extend so far that way, as the light will always spread farther on the thinner side. In cases where the background is durk (and in such a case cases where the background is dark (and in such a case a toroughly satisfactory vignette can never be produced, even with a lot of hand work), the vignette should be close round the figure and should be held near the bromide paper; if the background is light, the vignette may be placed farther away. By holding the vignette in the hand a slight movement may be imparted to it, which also tends to soften the edges. The movement, as a rule, must be in the plane of the vignette and not towards the lens, and should be only slight. When vignetting a lady with a black dress, in order to avoid showing the waist (which would look too large) a piece of card, edged with cotton-wool pulled out loose, is fastened over the portion to be obliterated, but must not come within sight of the vignette opening.

Garden Paths.—For a parrow gravel path it will be

not come within sight of the viguette opening.

Garden Paths.—For a narrow gravel path it will be sufficient to excavate over the site of the path to a depth of about 9 in. below the intended finished level. Fill in 6 in. of this with broken bricks, good hard clinker, or broken stone, and ram this well so as to consolidate it as much as possible. On the top lay gravel and sand and roll with a garden roller. To make an asphalt path, excavate to a depth of 9 in. Put in the edging or kerbs of the path, and fill in the foundation as recommended above. The asphalt is laid in two layers. The bottom layer, about 2 in. thick, is composed of broken bricks or limestone broken to about 1 in. gauge and mixed with melted tar and pitch. The broken stone is placed in a heap on a wooden platform, the tar is poured over the heap, and the whole mass turned over several times with spades. Let the stuff remain thus for a week or two before laying. Lay this bottom course to a depth of 2 in, roll it well, and finish off with a coat of similar

giving say one thousand times the exposure necessary for a plate. Another plan is to expose the bromide paper as if for the production of a negative, and then fog the paper by exposure to light for a minute or two before development. This has often been done as a lecture experiment, but is very uncertain.

1/2" bolt IR" centres

lecture experiment, but is very uncertain.

Dyeing Leather Black.—Below is explained how to dye brown leather a good black colour. Get some salts of tartar and some green copperas, and make a solution of each of these in soft water. Lay the leather out flat on a board and wash over carefully with the salts of tartar, using a sponge, and with the open hand rub the leather all over until nearly dry; afterwards allow it to become thoroughly dry. Now wash with the copperas solution, following the method above described; and when dry wash again with paste water—i.e., water in which a little paste has been mixed; this will take away any whiteness that has been left from the copperas, and, if properly done, will produce a good black. But the tone will be governed somewhat by the original colour of the leather.

Drilling Pinjon with Watch Turns—To drill a

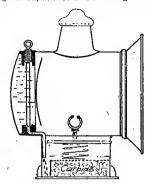
Drilling Pinion with Watch Turns.—To drill a pinion in a pair of watch turns, first mark the exact centre with a sharp-pointed chamfering tool. Then select a drill of the right size, harden it, and leave it quite hard; sharpen it well, and fix it in a hole drilled centrally up a brass runner to fit the turns. See that the drill is straight and true. To drill the pinion, fix a ferrule ou it and set it up in the turns, the back pivot running in a centre, and the drill point (in the brass runner) running in the chamfered centre to be drilled. While the piniou is revolved by the bow, the brass runner with drill is held in the hand and a good pressure kept on it. Lubricate with turps, and keep the drill sharp. shārp.

Gunmetal.—The following alloys may be taken as typical samples of good gunmetals. Copper 57 parts, tin 14, zinc 29; copper 86, tin 11, zinc 3; copper 64, tin 16, zinc 12; copper 96, tin 13, zinc 41. A small quantity of lead is admissible in two or three cases only, as, for instance, gunmetal for glands and cocks, which may be, say, copper 80, tin 4, zinc 131, lead 21; and also piston rings, which may be, copper 82, tin 4, zinc 9, lead 5. For ordinary use however omit lead. ordinary use, however, omit lead.

Wax Taper Manufacture.—Machinery employed in modern establishments for making wax vestas and wax tapers consists of a shallow jacketed pan for melting the wax by steam, and a large revolving drum on each side. On one side of the pan, hetween it and the drum, is a plate of steel with a number of holes about \$\frac{1}{2}\$in. in diameter drilled through it. The wicks are wound on one drum, and are drawn through the bath of melted wax; then each set of wicks is drawn through one of the holes in the steel plate and on to the other drum. The wax is heated to a few degrees above its melting point so that it sets on the wicks quickly; the steel plate removes the excess of wax and forms the tapers round. The taper material is quickly unrolled from the second drum, laid on a tuble, and cut to proper lengths with very sharp on a table, and cut to proper lengths with very sharp knives

knives.

Acetylene Lamps for Vehicles.—Acetylene plants that work quite perfectly for residences are numerous, but whether any self-contained lamp for cycles, automobiles, and other vehicles is perfect is doubtful, owing to the fact that it cannot be attached to an adjustable gasholder that will receive the gas of overgeneration and after-generation. The exact quantity of acetylene that is made is not the exact quantity of gas that is used; acetylene must be made in excess, or the light will fail. To allow for this, vehicle lamps are provided with means (a kind of miniature safety valve being often used) by which this excess of gas escapes or is wasted; the gas of after-generation (that which is produced after the water supply is stopped and the flame extinguished) is also allowed to go to waste. Some



Acetylene Lamp for Vehicles.

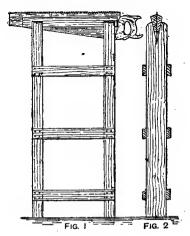
lamps are unprovided with means of extinguishing the light, and the gas of after-generation is then allowed to burn out in the house or stable. The accompanying illustration shows a favourite method of regulating the water supply to the carbide, and, consequently, regulating the production of gas, and it is thought that this device does not infringe any patent. The water vessel is at the back of the lamp. The flow of water to the carbide chamber is a very slow of mater to the carbide chamber is a very slow of mater to the carbide chamber is a very slow of mater to the carbide chamber is a very slow of the lamp. The flow of water to the carbide chamber is a very slow of the lamp in the content of the lamp, but a better plan would be to have the holder under the water chamber, so that the small tube from one to the other can be quite straight, which would be desirable for cleaning purposes. The water should not be allowed to drip on to the top of the carbide, but should rise from below, as shown. In all vehicle lamps a piece of coarsemesh wire gauze should be placed over the carbide and held down by a broad form of spring. This device is necessary in order to prevent disturbance of the carbide and irregular results caused by jolting of the vehicle. The lower part of the lamp carrying the carbide chamber must be readily detachable for purposes of recharging and cleaning, but of course it should be gastight.

Recharging Seltzogene.—To open a seltzogene unscrew the metal cap containing the valve and tube. For charging, first thoroughly wash out the vessel and allow it to drain, then the lower bulb must be nearly filled with water, poured through a funnel which penetrates the neck of the bulb; no water should be allowed to get into the upper bulb. When the lower bulb is nearly filled, the funnel should be withdrawn and the small conical plug put in the neck of the lower bulb to prevent any powder getting in. A charge of powder is now run into the upper bulb by means of the funnel, and after the funnel and the conical plug are removed, the cap must be screwed in again. On placing the seltzogene on its side some of the water flows out of the lower bulb into the upper one, and meeting with the powder

causes it to effervesce, the gas evolved heing absorbed by the water in the lower bulb. A minute later about a wineglassful of water should be drawn off and the seltzogene shaken gently once or twice. After about half an hour the aerated water may be drawn off for use. Powders for charging the seltzogenes may be obtained from any obemist. The necessary ingredients for the charge are stated in Series I., p. 159; they are in the proportion of loz. of tartaric acid and lib oz. of bicarbonate of soda for a 3-pint seltzogene.

Gold Bangles and Bracelets.—In making hollow gold bangles and bracelets, draw the gold plate over well-annealed charcoal iron wire, turn the plate up round a mandril of the size required, and cut off. The inside metal (the iron) may readily he dissolved out by using dilute sulphuric acid. The best alloy of gold to withstand the action of the acid is made by melting together 15 parts of fine gold, 3 parts of silver, and 6 parts of copper.

Re-covering Clappers of Smith's Bellows.—For re-covering the clappers of a smith's bellows, it is necessary to remove the old leather from the clapper, and get a new piece of stout sheepskin leather, known in the trade as basil; place a thin packing of wadding between the clapper-board and the leather, and then nail the leather round the edges of the clapper.



Hand Saw Vice.

Hand Saw Vice.—The vice for hand saws, shown in front and side elevations by Figs. 1 and 2, may be made of two pieces of 4-in. by 2-in. deal, 4ft. long, held together with six pieces, 4in. by 2-in., nailed on. The uprights are rounded at the top, and have V-shaped notches, 4in. deep, cut in them, to take the wedge-sectioned cheek pieces (see Fig. 2), which are best if made of walnut. The vice simply stands against the bench, the saw is placed in notches, and the cheeke are pressed down tightly with the fineers. the fingers.

Re-waxing Meerschaum Pipe.—A meerschaum pipe may be re-waxed after first carefully cleaning the pipe with soft rag wetted with methylated spirit and dipped in punice powder, finishing with clean, soft rag. To re-wax, place a small spirit lamp beneath the pipe, but near enough to the pipe to keep it sufficiently warm to melt a piece of white wax held against it. Let the wax touch those parts only which are intended to be coloured, and when the pipe is cold, wipe off the superfluous wax with a soft rag. Pipes can also be re-waxed by merely making them hot enough with smoking to melt the wax. Any colouring wrongly placed can be removed by dipping the bowl to the required depth in chloroform. Re-waxing demands care and patience. and patience.

and patience.

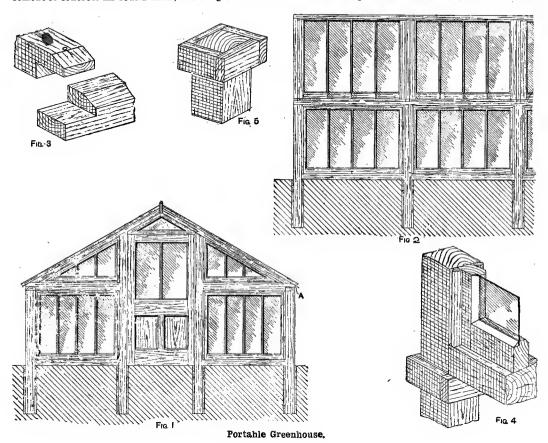
Bloom on Green Paint.—Bloom that has formed on green paint may be due to one of several causes. Perhaps the most probable cause is that the green pigment has not been washed sufficiently clean or free from acid during the process of manufacture. When preparing green pigments for any particular purpose, avoid as far as possible mixing with basic colours as zinc white, white-lead, orange chrome, and ultramarine, as the mixture sconer or later is destroyed, owing to these pigments containing traces of sulphur and alkaline bodies. Any traces of lime would also cause the bloom complained of.

Preventing Water Freezing.—Chloride of lime (bleaching powder) is employed for preventing water from freezing, but it cannot be put in drinking water or water used for many other purposes. It is commonly used for the water in hot-water heating circulations, which are allowed to get cold in frosty weather (in churches for instance); but in this case it is heat to buy the solution ready prepared.

Portable Greenhouse.—Fig. 1 shows an end elevation, and Fig. 2 part of side elevation of a portable greenhouse, the sections of the ground showing sockets with posts fitting in them. By having a number of these sockets fixed in different parts of the ground, the greenhouse can be removed from one site to another, as may be required by the plants, and to retain these sockets in their positions, it will be necessary to put a layer of Portland cement or concrete all round them, and the greenhouse

thus leaving the centre of the hammer hot to bring the faces to the right temperature for hardening. When the faces are cooled out, rub them bright with sandstone, and when they are of a deep straw colour cool them alternately in the water to arrest the softening process, and so continue until there is not sufficient heat in the centre of the hammer to make any difference to the faces. By this means the faces will be hardened and the eye of the hammer left soft. If there is not sufficient heat in the centre of the hammer to bring the faces to the desired colour, a plece of hot iron should be placed through the eye.

Marbling Mantel and Staircase.—For finishing a mantel and stairs in imitation of green marble, first prepare by rubbing the surface of the mantel perfectly smooth with No. I glasspaper, and apply a coat of black or dark coloured distemper mixed with a little raw oil to fill all



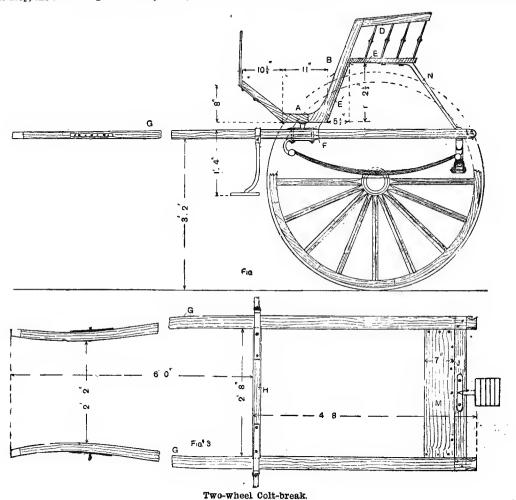
must not be removed until this is set. Fig. 3 illustrates the joints of the framework at A (Fig. 1), the other joints being ordinary mortise-and-tenon joints. For holding the framework together and for expeditiously taking it apart, the principal joints should be made by screws. Fig. 4 shows the method of holding the lights in position between the posts. This is done by natling a guard head inside and out so as to form a groove in which the lights slide. When the greenhouse is moved to a new site each socket should have a plug (Fig. 5) dropped into it to keep out dirt, etc. For hingeing such of the roof lights or side lights are require them, lifting hinges will be found most suitable. As the posts go in the ground the sills drop between them. The lights and door will, of course, be of the ordinary construction.

Hardening Cast Steel Hammer.—To harden the faces of a cast-steel hammer that is several pounds in weight, make the hammer red hot all over, then grasp it with a pair of tongs through the eye; slack one face of the hammer for about 1½ in. up until quite cold in water, then slack the other face for the same distance up,

inequalities; again rub down and dust, and apply a coat of black paint mixed with boiled oil and a little driers and turpentine. Then give a second coat of paint mixed with 3 parts of oil and 1 part of turps; ruh lightly with No. 0 glasepaper and dust well. The marbling may now be proceeded with. Obtain some white-lead, and light and middle green paint ground to a paste in oil; moisten a long stiff feather with turps, and place a small quantity of each of the colours on the feather and draw it over the work in the style to be imitated. Allow to dry, then apply a coat of hard copal varnish. The stairs and skirting boards should be well ruhbed with No. 1 glasspaper, and a coat of black paint mixed with 2 parts of oil, 1 part of turps, and a little terchine applied; in some cases two coats are necessary. The marbling should then he done as above, finishing with a coat of hard copal or inside oak varnish.

Oiled Silk.—Oiled silk for dressing wounds is prepared by laying the plain silk on a table and applying a coat of oil gold size or boiled linseed oil to one side. The silk should then he hung up in a warm place to dry quickly. Painting Bands round Pillar.—One method of painting the perfect bands on pillars is to place a straightedge against the pillar and make a mark or dot with a lead pencil at the desired height. Now move the straightedge about 1 in. and make another dot, and continue this all round the pillar. Now place round the pillar, just touching the pencil marks, a piece of strong paper. A sash tool dipped in the chosen colour should be used to stencil on and below one edge of the paper. When the paper is removed, a perfectly clean and sharp line will be found. Treat the other edge in a similar manner, then fill between the lines in the ordinary way. Another method is to procure a piece of stout paper the exact circumference of the pillar, and about 9 in. deep, the ends being cut exactly at right angles to

on to the sham door B (Fig. 1) from the joint to the back end. The sham door is cut out of 2½-in. plank to the shape of Fig. 1, and the turn-under sweep is as shown in Fig. 2; the seat E (Fig. 1 and 2) is 1 ft. 6 in. wide by 2 ft. 11 in. long, of 1-in. birch; the top rail D (Fig. 1 and 2) is compassed, and is of English ash 2½ in. equare; it must be obtained from a timber hender. When dressed up, the rail is 2 in. deep, worked round to the bevele to 1½ in. in thickness; the turned sticks are ¾ in. in diameter at the end, tapering to the swell in the centre. The heelboard E (Figs. 1 and 2) is ¾ in. thick, and may be of birch or whitewood; the bottom boards are boxed or rebated into the inner bottom edge of the brackets A (Fig. 1), and the cross bar is framed in at F. The width of the break across the bottom is 2 ft. 4½ in., and across the top rail 1

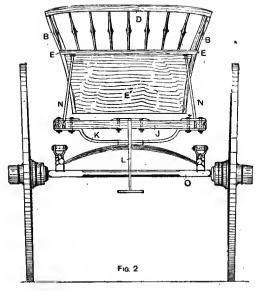


the length or parallel to each other. Place the paper round the pillar, the bottom edge of the paper just touching the part where the top of the band is required. The extreme ends of the paper should now just touch each other, and its top and bottom edges should be perfectly even; the circle or band will then be at right angles with the pillar and may be stencilled on as before. This method is useful when the height will not admit of a straightedge being used. The worker requires an assistant to hold the paper while stencilling.

Two-wheel Colt-break.—In the accompanying illustrations Fig. 1 is a side elevation of a two-wheel colt-break built on the lines of a gig, but without the body part, Fig. 2 is a top plan of the framed shafts. In making the break, the brackets A (Fig. 1) and sham door B (Figs. 1 and 2) are got out to pattern in thoroughly dry English ash; the brackets are 2 in. deep at the bottom, tapering off to the top, 23 in. wide, and are half checked

(Figs. 1 and 2) 3 ft. 6 in. outside; the clear distance on the seat between the sham doors is 2 ft. 7 in. The shafts G (Figs. 1 and 3) are of ash, 6 ft. long in front of the bar H (Fig. 3), and 4 ft. 8 in. from the front of the bar to the extreme end. The shafts are 2½ in. at the back end by 2½ in. deep, tapering to the front as shown in Figs. 1 and 3. The hind bar J (Figs. 2 and 3) is 2½ in. wide, framed through the shafts as shown; it takes the hind flaps of the span-iron K (Fig. 2), which takes the cross-spring, this being fixed to the flap of the span-iron by two spring clips and couplings, with a ½-in. ash block fitted to the compass of the cross-spring hetween. The hind step L (Fig. 2) is for a man to get up and stand behind the driver on the board M (Fig. 3), in case the driver cannot manage to get the colt along; there is generally a long leather strap with a loop at the bottem end fixed round the centre of the top rail of the seat. To secure the board M (Fig. 3), fillets of ash 1½ in. deep by 1½ in. wide, are fixed on the inside of the shafts and bar, the fillets

being kept level with the bottom of the shafts and bar; a piece of I-in. blrch is fitted between the shafts and fixed by screws. The two stays N (Figs. 1 and 2), to support the seat, are of 1-in. oval iron, tapering towards the bottom, with a loug flap to go under the seat (see Fig. 1), and with tee flaps at the bottom on top of the shafts and bar. The wheels are 4 ft. 6 in., Warner's; the stocks are 7 in. in diameter at the band of iron, mortised to take sixteen 1\(\frac{1}{2}\) in. spokes, the length of the stocks being 8\(\frac{1}{2}\) in. The axle 0 (Fig. 2) is a Collinge, 1\(\frac{1}{2}\) in. in diameter, with solid flaps for 2-in. springs; the distance between the flap and collar of the axle is 1\(\frac{1}{2}\) in., and the boxes of the axle are 9 in. long. The side grasshopper spring is 3 ft. 6 in. long to the centre of the eyes, the compass from the centre of the eyes to over the last plate being



Two-wheel Colt-break.

5in., and the number of plates six, of 2-in. steel. The cross-spring is 2 tt. 11 in. to the centre of the eyes; the compass from the centre of the eyes to over the last plate is 4½ in., and the number of plates six, of 2-in. steel; the springs are fixed in front in an open jaw scroll iron, kept in position by a ½-in. bolt. At the back end the springs are attached to the cross-spring by four D shackles, with four ½-in. bolts through them; the track of the wheels is 4ft. 4in. The back is kept rather wide for such a narrow bottom at the brackets, to prevent the break being turned over.

Laying Oak Floor on Old Boards.—In laying an oak floor of narrow boards on top of an old floor, the proper and most workmanlike manner will be, first, to level off all projecting knots and other inequalities with a plane, and any parts where the floor is very much worn must be firred up, and made quite level to a straightedge; the firring must, of course, be done the opposite way to the joints of the new floor so that the latter will have an equal bearing over the whole area. If the new floor is laid without firring up the old one, the joh will prove very unsatisfactory and give constant annoyance owing to its uneven surface and creaking joints.

Rubber Stamps.—The would-be rubber stamp maker is often discouraged on finding that uncured rubber must be obtained, and that it requires careful treatment by heat; however, below is described a method of making indiarubber stamps from rubber already "cured," the material that many are familiar with in its applications to tyre making, particularly for inner tubes. Unfortunately the process has its limits, but for many purposes it is, when skilfully put into execution, equal in results to mould-cured productions. A piece of grey sheet rubber, readily provided from the remains of a worn-out inner tube, or to be bought direct from any cycle or indiarubber dealer, will be required. When bought in the sheet it is known as "patching rubber," and most repairing outfits contain small pieces of suitable rubber. Fix it down to a piece of smooth flat board, which for small jobs may be about 6 in. or 9 in. square. Ordinary thin glue will do this, but many other

cements will also accomplish it. When firmly fixed and quite flat and smooth, draw the required design or lettering on the top surface. If preferred, printed letters, etc., can be cut out and pasted on the rubber instead of heing drawn. When dry (in the latter case) use a sharp knife to make a vertical cut to penetrate the rubber all round the outlines of the pattern or letters down to the wood on which the rubber is stuck. Every time it is removed from the cut, moisten the edge of the knife by applying the tongue to it. It is not advisable to saw the blade backwards and forwards when cutting; merely press down. An alternative way is not to stick the rubber to the wood, but to cut it with a pair of sharp scissors, though these are more likely to produce jags and uneven cuts than the knife. When cut out the rubber may be stuck to a wooden handle with a flat end big enough to take it, and can then be used with an ink-pad in the ordinary way. It will be seen from the above that small-lettered type would be beyond the scope of the process; but for monograms, for large letters such as are usually stencilled, and for designs of all kinds, it will give complete satisfaction to designs of all kinds, it will give complete satisfaction to the careful workman. Type, etc., must be cut in reverse, and if printed letters were stuck down, the rubber must be mounted so that its hitherto underneath surface be comes the working surface.

Painting Mailcart.—The method of painting mail carts usually adopted by manufacturers, which is far better than enamelling, is as follows. Obtain 1 lb. of olive green colour, ground to a paste in turpentine, add two tablespoonfuls of gold size, mix well together, and thin down to proper consistency with turpentine. The mailcart should be given one coat and allowed to dry thoroughly, when it should be lined out with light stone, middle chrome, or pale blue, which should be prepared from good quality paste paints thinned down with turpentine, adding a little gold size as a binder. Finish off with a coat of hard-drying copal varnish.

Cement for Fixing Fireclay Bath to Marble Base.

For fixing a fireclay bath having an uneven bottom outside on a marble floor a cement is necessary to bed the hath on. As the cement will uot be seen, a mixture of red- and white-lead with linseed oil varnish or old boiled linseed oil, mixed together to the consistency of very soft putty, should answer well. If something cheaper is required, then take 5 parts of white-lead, 2 of red-lead, and 4 parts of pipeclay, and mix with linseed oil varnish. An even cheaper mixture is made up of 24 parts of Roman cement. Sparts of white-lead, 2 parts of litharge, I part of powdered resin, and 8 to 10 parts of boiled linseed oil.

neart of powdered resin, and 8 to 10 parts of boiled linseed oil.

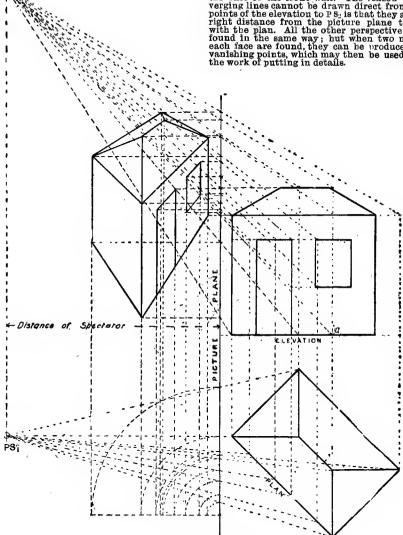
Neat's-foot Oil.—Neat's-foot oil is made from the feet of oxen, etc., obtained from slaughterhouses. The feet are first washed in cold water to free them from any dirt or blood; the sinews are then removed, and this hoofs placed in boiling water to soften. They are then disjointed with a knife to sever them from the large bone. The latter is boiled for some time by steam, and the remainder is boiled in a pan with water which has been used previously for the large bones. The water is next left for some time so that the oil may rise to the surface and be skimmed off. The oil thus collected deposits a thick stratum of dirty semi-fluid fat, from which the supernatant portion is decanted. These are known as first and second qualities. Neat's-foot oil has a pure straw colour, sometimes with a slight greenish shade, and when fresh has a peculiar mild taste and odour. Its specific gravity is 0'915, and it solidifies at 22° F. It keeps a considerable time without turning rancid, but is subject to many adulterations which may often be detected by taste or odour, the principal adulterants being horse-foot oil, sheep's trotter oil, and very often fish oil. It forms when pure an excellent lubricant for light machinery, as clocks, phonographs, cycles, etc. For use with watches, 2 parts of benzine to 1 of oil should be mixed together and placed in a room at 49° F. and allowed to stand two or three days; then pour off the clear finid, evaporate the benzine with water bath, and repeatedly agitate the oil which remains with 5 per cent. of fine carbonate of soda; place the oil in bottles, close these well, and let the oil stand to settle several weeks, when the clear oil may be decanted off. The oil thus produced may he used on the finest and smallest mechanical work. It remains fluid below freezing point, being therefore rich in olein.

Dissolving Russian Isinglass.—Isinglass may easily be discolated by holiver with water under measure in a

Dissolving Russian Isinglass.—Isinglass may easily be dissolved by boiling with water under pressure in a digester, which is an iron or copper pan, with a lid which can be fixed on and made tight with rubber packing; in the lid is a valve fitted with a lever and weight to regulate the pressure at which steam will blow off. In dissolving singlass by ordinary boiling, if alkali is no detriment to the material, a very little canstic soda added to the water will help to bring the isinglass into solution.

Bird's-eye Perspective.—The principle of making bird's-eye perspective views is shown in the accompanying illustration, which, however, looks distorted owing to the position of the spectator being taken very close in order that all the lines may be kept within a small compass. Oraw a vertical line to represent the section of the picture plane. Place the plan near it so that the sides make 45° with the plane. Select the point of sight

of PS₁ to cut the line of 45° in elevation in point PS₂. For perspective view commence with the bottom left-hand corner of the elevation, draw a line to PS₂, and where the line intersects the picture plane draw a horizontal line to cut the projection of the simil r point from the plan. Now take the bottom right-hand corner of the plan and project upwards to the base line of the elevation, and from this point (marked a) draw a line to PS₂. At the intersection of this line with the picture plane draw a horizontal line to meet the projection from below, and draw in the perspective view of the base of the front wall. The reason why the converging lines cannot be drawn direct from the various points of the elevation to PS₂ is that they are not at the right distance from the picture plane to correspond with the plan. All the other perspective lines will be found in the same way; but when two main lines on each face are found, they can be produced to find the vanishing points, which may then be used to facilitate the work of putting in details.



Bird's-eye Perspective.

or position of spectator (PS₁ in plan) opposite the nearest angle, not less than l2in. from it, or at such greater distance as will include all lines within an angle of 30° and draw lines from all points of the plan to the point of sight; the lines may, however, if preferred, be drawn singly as they are wanted. Now draw a horizontal line at or helow the lowest intersection with the picture plane, and turn all points through a quadrant on to this line. These points projected upwards will give lines in which the perspective points will lie. Now draw the elevation of the building the same distance from the picture plane. Select the point of sight in the elevation about 45° above the nearest corner of the roof, and the same distance as before square out from the picture plane; or in other words, project from the plan

Painting Grandfather Clock Dial.—Floral and other designs are painted on grandfather clock dials in oils by hand. To repaint first remove the old paintand thoroughly clean the plate: it is then given a coat of white enamel. The minute circle is struck, and the hour marks can he transferred by a tracing made on paper from the old marks before removing them, or they can be re-marked with the aid of compasses. First set the 12 and 6 o'clock on a perpendicular line, then the 3 and 9 on a horizontal line at right angles to the first line. Then with the compasses divide one of the quadrants into three equal spaces and step them round the circle, thus marking the other hours. To mark the minutes, divide one hour division into five by the compasses by trial, and, when correct, step the compasses round the other hours,

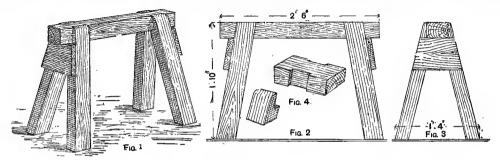
Essences of Cinnamon, Lemon, and Orange.—
These essences are easily made by dissolving the essential oils in spirit of wine. To make ciunamon essence, dissolve 1 oz. of oil of cinnamon in 20 oz. of rectified spirit. For essence of lemon, dissolve 1 oz. of oil of lemon in 8 oz. of spirit of wine, add 1 oz. of grated fresh lemon peel, aflow to stand for two or three days, then filter. For orange essence, proceed as in making lemon essence, but using oil of orange and fresh orange peel.

Hardening Tallow.—Tallow candles "gntter" because the tallow melts at a low temperature, and in a candle made of tallow alone much more melts than can be drawn up by the wick and burnt; also currents of air cause the heat to play on one side of the candle, thus melting it and allowing the material to fall down that side. To obviate the first difficulty, it is necessary to add to the tallow a material of higher melting point than tallow; cerasin wax with a melting point of 150° to 160° F. is often used for this purpose. Carnauba wax is also useful, its melting point being 180° F., but it is difficult to incorporate it with tallow, as it tends to separate out in a granular state at the low temperature at which tallow candles are made. To prevent "guttering" from air currents, the candles should be fixed in sconces and covered with lamp glasses.

Sawing Stool.—The illustrations show the kind of stool in common use by carpenters. Fig. 1 is a general view, Fig. 2 a side elevation, Fig. 3 an end elevation, and Fig. 4 the joint between the leg and the top. The

paint pots and varnish cans. When taken from the tub, the paint should be thinned down, so that it may be strained through a hair sieve or some coarse glueing canvas. To tell when the paint applied to the tilt is tacky, place the finger lightly on the paint, then remove the finger slowly; if the paint adheres to the finger and comes up in the form of small threads, the canvas can be put on, stretching it out as tight as possible. Then make a pack of canvas and well rub the surface from the centre to over the corner, an assistant pulling it tight at the same time. A sleeker of wood or iron with a round end is then used to press out the superfluous paint, and will make the canvas stick to the tilt.

Plano Soundboards.—Plano soundboards usually are made from Swiss pine, but may also he made from American pine or spruce; the wood must be perfectly clean, free from shakes and knots, and thoroughly dry; ½-in. boards are used, and these, when planed on both sides, should finish out ¾ in., being a trifle thicker at the treble end and at the bass bottom edge. The bars that are glued on the back between the bracings are planed up slightly camber, the middle stauding up ¾ in. higher than the extreme ends, and these when fixed into position will give the soundboard a slightly arched appearance. The method of fixing is by "go bars," lengths of lancewood elightly longer than the distance between the ready planed-up board when resting on some firm foundation, such as the floor, or on stout boards placed across trestles, and the ceiling above. The latter in piano shops is of wood, not placter. The bars being glued on, the "go bars" are sprung into position, at least three



Sawing Stool.

1.

suggestive sizes are figured on the drawings. The scantling can, of course, be increased or decreased, according to requirements.

Diamond Setting.—To make a star setting for a single stone in a ring, a hole is drilled and opened out to a little smaller than the stone; a ledge is then cut round for the stone to lie in leaving a depth of gold above its edge sufficient for the corns or claws to press over it. The star points are then cut with a graver, leaving a corn in the centre of the broad base of each. This corn is undercut at the back so as to facilitate bending. The stone is then placed in, and the corns bent forward so as just to hold it. A small punch and light blows all round equally will bend the corns over the edge of the stone firmly. The ring can be conveniently held on a tapered stick.

Covering Tilt of Box Van.—It is not usual to cover tilts with a number of small pieces of material; one or two pieces are generally employed. When two pieces are used, they are joined on top in the centre of the roof, brought down each side, and fixed to the hottom rave of the tilt. To make a good joh, procure some black dressed canvas 60 in. wide, or double brown canvas 72 in. wide. To save painting, japanned canvas, 72 in. wide, can be obtained, this having a black surface and being very smooth; when put on a tilt where writing has to be done, it must have the gloss taken off by fine pumice powder and a pad of cloth and water, and a coat of varnish must be given after the writing is done. For a white cover procure some white double-texture waterproof sheeting which does not require painting, and black writing would show up well on the surface. Neither the japanned canvas nor the white sheeting requires sticking down, as each is stretched tight with a pair of pincers with tee-shaped jaws, and taken to the bottom of the tilt, where they are fixed. If brown canvas is used, which costs about 2s. 6d. per yard, the tilt would have to be given a very heavy coat of smudge paint, which is the draining of all

on each bar, consequently giving a strong downward pressure. They may also he fixed by glueing one bar on the back in its position and nasing another at the front, which, however, must not be glued, the rounded or camber edges being of course text the soundboard. Hand-screws are put on the extreme ends, exerting pressure till close contact is assured.

Black Japan or Shiny Black.—For making a quantity of black japan, or shiny black, melt 81b. of finest asphaltum in a suitable vessel and afterwards add 1½ gal. of pale boiled oil. In another vessel run 3 b. of copal gum with a gentle heat over the fire, and add 5 pt. of test drying oil; stir well and raise the temperature to 500° F., then add steadily 11b. of redlead, 11b. of lithange, and 21b. of white copperas. Boil well until the mass turns stringy and sets between the fingers when cool, then mix the contents of the two vessels together, allow to cool somewhat, and stir in carefully 5 gal. of American turpentine. Allow the mixture to repose for about fourteen days, when it is ready for use. It dries hard with a lustrous coat in about eight hours.

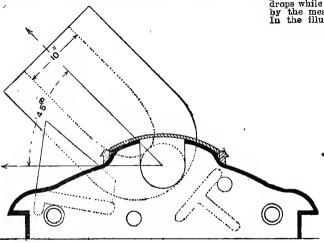
Cleaning Rainproof Overcoat.—A fawn-colonred rainproof overcoat that has become dirty may be cleaned in the following way. Cut 1b. of Castile scap (white) into shavings and hoil with 1 qt. of water till dissolved; then remove from the fire, and when somewhat cooled add 5 oz. of methylated spirit. Spread the overcoat over a table and brush it well with the hot scap solution. This should be applied to one portion of the coat at a time and immediately afterwards wiped out again with clean wet cloths. After going over the whole of the coat in this way, wring out the cloths and again rub over the coat. Any very dirty portions may have a little fuller's earth rubbed on while wet. Now dry very slowly, and when nearly dry place a cloth over the coller and cuffs and iron them with a moderately hot iron; after this finish drying. If the overcoat is rubber-proofed do not use the iron. The materials mentioned may be obtained from any chemist.

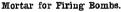
Welding Steel to Iron.—Below is described a method of welding a piece of steel 5 in. loug by 4 in. wide to a piece of iron 6 in. long, 5 in. wide, by 2 in. thick. First of all, ascertain the welding qualities of the bar of steel by submitting a piece of it to a practical test and seeing at what heat the steel will weld. When these particulars have been ascertained, cut off the piece of steel that is to be welded to the iron, and cut this piece a little longer than the finished size, so that to it a light porter bar may be welded; hy the help of this potter bar the steel can be more easily manipulated in the fire when getting the welding heat. If the operator has only one fire to work with, a good blast is indispensable; there should also be a fairish sized hole in the tue iron so that the blast may spread and make a fairly large area for obtaining the welding heat. The iron should be brought to a fair white heat and the steel to a kind of slimy heat, using for a flux some clean sharp saud if the steel is of good welding quality; if not, use sand and burnt borax mixed.

Mortar for Firing Bombs.—A mortar, as may be seen from the accompanying illustration, is a very short piece of ordinance (having the trunnions at the end) intended to throw shells at high angles of elevation, usually 45, variations in range heing obtained by alterations in the charge of powder. The mortar rests on a mortar bed, the elevation being, as a rule,

from there back to the boiler, then run the other pair the other way. This will provide one complete circulation doing one half of the room and another circulation doing the other half of the room. Both these methods will require two flow and two return connections on the boiler, and, if quick results are desired, such connections must be provided, because the quantity of large pipe to be heated is considerable. Other methods are to take a flow from the boiler, and, with a suitable fitting, make four pipes and carry them all round, ending in the boiler; but whether all four pipes would heat successfully is very doubtful. Another plan would be to start with one 4-in. pipe, convert this into two pipes, carry these all round, but, instead of letting them then enter the boiler, put syphon ends and run the pipes all the way back again before they join the boiler. With this plan the returns would not he very hot after travelling so far, and would be of small use as heating surface.

Gas Pressure Gauge.—To make a gas pressure gauge that can be attached to acetylene or other gas burners, obtain a piece of 4-in. or 5-in. glass tube and bend it U shape; this can be done in a gas flame, for preference a Bunsen flame, as it is smokeless. Fix the tuhe on a piece of board in the manner shown, and at a suitable point draw a zero line and mark it 0. Above this draw lines every half-inch and mark them as illustrated; each of these will indicate one-inch pressure, because the water level in one leg of the U drops while the other rises, and the pressure is counted by the measurement between the two water levels. In the illustration the pressure is shown at 3-in.







Gas Pressure Gauge.

constant. Mortars are not at present used in the service, but many large ones are still mounted in fortresses. Mortars were found useful for dropping shells into a confined space such as a fort or bastion, but they are not able to hit a particular object, such as a gun. Mortar shells which drop from a great height are capable of breaking through insufficiently protected powder-magazines, and searching out the weak buildings of a place generally. Their fuses were regulated so as to burst immediately after, but not before, striking the object. A small mortar may be made of brass,

Salicylic Acid Distemper Medium.—The following is a salicylic acid medium for distempers. Take glus size powder 51b., crude glycerine 12 oz., glucose 81b., salicylic acid 21b. Dissolve the glue size in about 5 gal. of hoiling water; in another vessel dissolve the salicylic acid with warm water, then mix both together after cooling somewhat, finally stirring in the glucose and glycerine. Should the mixture jellify, add more boiling water. This preparation should be used as a medium for mixing dry colours for distempers. Salicylic acid is poisonous.

Method of Running 4-in. Hot-water Pipes.—For heating a room by means of four 4-in. pipes run all round in a grated channel about 600 ft. of pipe will be required, and to make all the piping uniformly hot the best plan will he to divide the piping into two circulations. Let a 4-in. flow start from the boiler, then with an outlet syphon continue the piping as two 4-in. pipes all round the huilding, ending at the boiler. This will be one circulation, and the other half can be done in the same way, the pipes running allongside the first pair. An even better plan is to run the first pair of pipes, in the manner just described, half way round the room, and return

because the water levels are three half-inches above and three below zero. The thick black part is the water, which may be plain or coloured. The taps shown are not needed for pressure testing at a bracket, as the bracket tap answers, but a gauge made in this way serves another very useful purpose, as in the case of an installation of acetylene it can be made to indicate leakage, and for this the cocks are used. Attach the lower cock to any hranch or bracket (by a flexible tube will do, though not every piece of rubher pipe is acetylene-proof) and open this tap. Shut the main cock at the generator and all other taps. Now blow into the upper tap until a 14-in. to 16-in. pressure is indicated, and then close this tap. If the water level stands at this height, or close on it, for half an hour the piping may be passed as sound. It is very desirable to test the piping of an acetylene apparatus, as acetylene is a very searching gas, passing through a leak where coal gas would not go. Leakages are located by brushing soap-suds on suspected places, the leaking gas then blowing a bubble.

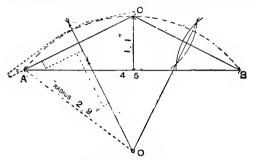
Paints free from Whitelead.—The ingredients are: zinc white 50 parts, pale boiled linseed oil 7 parts, pale copal varnish 2 parts, American turpentine 3 parts; mix well together and apply two coats, following with a coat of colourless copal varnish. This is a durable white paint which may be used with advantage as a substitute for white-lead, and is non-poisonous. A cream colour may he obtained by adding loz. of Italian ochre to every 141b. of the ahove. A non-poisonous olive green may be prepared by mixing well together zinc white 14 parts, yellow ochre 3 parts, ivory black 1 part, hoiled oil 4 parts, American turpentine 1 part, oak varnish 1 part; apply two coats, and finish with best outside oak varnish.

Gumming Envelopes.—Gum arabic when used for envelopes is dissolved in water and strained through muslin or a very fine hair sieve. It is not necessary to let the gum stand—in fact, it should always he used as fresh as possible. Gum standing for any length of time will take up impurities from the atmosphers. A flat camel-hair brush is best for applying the gum to hand-made envelopes. The envelopes are laid on the bench and "fanned out" or spread out a number at a time, and the brush, well charged with gum, is drawn lightly over them while being held in position with the left hand. They are then carefully spread out on a hoard and left to dry.

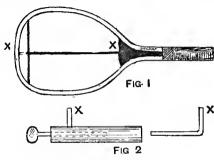
Striking Segmental Arches.—In striking segmental arches, if the measurements are to be taken from the actual openings, the rise may be ascertained either by holding a straightedge to the springings and measuring with the rule the amount of rise at the middle, or a rod may be cut square at one end, and this end rested either on the sill or the floor as the case may be, and the height of the springing, or point where the arch starts, marked upon the rod, and also the height of the crown or middle of the opening; then the difference between the two heights will be the amount of rise. To ascertain the radius of any segment, when the span and rise are known, proceed as follows. Draw a straight line AB (see illustration) equal in length to the required span (in the instance given this is shown as 4ft. 5in.); at the middle of this line and at right angles to it draw another line equal to the rise at C. which is lft. lin.; join the ends of these lines by other two lines AC, BC; bisect these lines, and the intersection of the bisectors will be the centre of the required segment. In the case of large segments to be set out in the workshop, the method of

of the snamel now used allows damp to strike through to the frames from outside; and in the third place, the priming now in use is defective as a protection against damp, and consequent rust. In some experiments a steel tube was covered with three coats of Mander's priming, and then half of the tube was painted with a paint composed of white-lead, polishing copal varnish, and turpentine; the tube was then baked for three hours at 320° F., and hung in a room where the atmosphere was exceedingly damp. In two months' time the part that was only covered with the priming was a mass of rust, the priming having practically disappeared; but on the painted portion there was not the slightest sign of rust even down to the extreme edge, and on scraping this coating off, the tube was perfectly bright underneath. The white-lead, varnish, and turpentine mixture will staud the necessary stoving perfectly.

Restringing Teunis Racket.—Gut for restringing tennis bats must not be wetted or even damped with hot or cold water to make it pliable, or it will be spoiled. To restring a racket, cut out the old gut, pick out all pieces from the holes and grooves, and well wipe round the frame with a Freuch chalk rag. Get a couple of awls in handles, and push one through the holes to clear them. Gut may be bought in 18-ft. lengths, and a full-size tennis bat takes two such hanks. Hook a hank on a ring and, holding it in the hand firmly, undo it gently without knots. Put the centre on the hook or handle and get hold of each end and walk hackwards, stretching the gut, and if no knots or kinks are in, pull it tight; this makes it pliable. Count the holes round the racket and find the centre two at the top. Start in these so as to work half of the racket at a time, and thread through



Striking Segmental Arches,



Restringing Tennis Racket.

finding the length of the radius rod is shown on the left of the illustration; proceed as before to lay off on two lines at right angles to each other the rise and span, drive in three nails at points A, C, B, and rest a straightedge against the nails as shown by the dotted outline, measure with the rule the exact centre between A and C on the straightedge, and at this point hold the edge of a carpenter's large square, marking its edge on the floor or board; repeat the process on the other side and produce the lines until they meet in the point O, and the distance from O to A or O to B is the required radius (in the given case 2ft. 9iu.).

Defective Tone in Clarionet,—If a clarionet becomes husky and unpleasant in tone after being played on for a few minutes, it may be that the read, being just stiff enough at starting, becomes less elastic as it gets warm and saturated with moisture. The remedy would be to substitute a reed somewhat stiffer, that would retain its spring even when moist and warm. Reeds will not last for ever, and some are soon rendered useless. Or the mouthpiece may be of unseasoned wood, or the face not square to the grain; or the wood, if laid when dry, will, when wet, alter sufficiently to make the bedding of the reed different in condition from what it was when playing began. In this case the remedy is to insert a new mouthpiece or to relay the present one when moist after playing. It is imperative that the curvature of a clarionet mouthpiece should be equal on each side of the aperture, and not "in winding."

Preventing Rust on Cycle Frames. — Dealers and users of cycles are often troubled with spots of rust on the enamelled parts, for even carefully stoved new machines will often break out in rust spots all over the frames. The weldless steel tubes now employed are so porous as to allow damp and rust to strike through from the inside; secondly, much

and through till the two ends come off to a finish. Lift the loop outside the racket and put the ends through. After the main gut is in and the ends under several of the loops are down, the racket must be tightened up. To do this is a very difficult job, hecause if a support is not int in the bat (see Fig. 1), pulling on the gut string to bring the slack through will pull down the top of the bat. To prevent this a tool in two pieces (Fig. 2) is used, one piece fitting in the other. The plug when in place butts against a thumbscrew, by which it is adjusted to any length. When this support is put in, the cross string can be started in the top side at a V of W shaped groove. Trace over and under each main string, but see that the right hole is worked when the gut comes out on the other side so as to drop in the channel or groove that is made to receive it. Pull on each string and wedge it by a smooth pointed awl in the hole where the gut is being held. Two awls are wanted so as to keep one string tight while pulling on the other. When the cross strings are nearly done the support X X (Figs. I and 2) should fall out, proving that the racket is of about the same shape as it was before being worked.

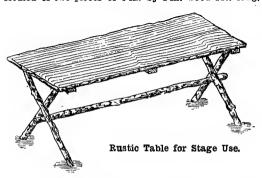
Water Freezing in Outdoor Cistarn.—To protect

Water Freezing in Outdoor Cistern.—To protect the contents of cisterns situated in outdoor attached buildings from freezing, the cisterns should be hoxed round with timber and the intervening space carefully packed with sawdust or slag wool. The pipes leading up to the cistern should be wrapped round with brattice cloth; another method is to lay the pipes between two grooved pieces of timber, say 3 in. by 1½ in., somewhat in the manuer that electric wires are laid in a wood groove. If only the cistern is affected, a lamp might be kept burning near the cistern while the weather is severe. Another method (but one that is unfair to the water company) is to place a weight upon the hall of the ball tap, and thus the water is kept running.

Enamelling Cycle Aluminium Colour.—The best way to enamel a frame in aluminium colour is to coat the frame with japanner's gold-size to which has been added a little stoving varnish. Stove until tacky, and rub over with aluminium powder. Then stove until hard. Give a coat of good stoving varnish, and again stove. The best way to harden aluminium paint which has dried without heat would be to apply a coat of good copal varnish and put the cycle away in a place free from dust until thoroughly dry.

Fancy Shading on Marble Paper.—Fancy Spanish marble papers are all produced on gum dragon alone; in fact, there is no better medium for the purpose. It is impossible to describe the exact method by which any particular effects are produced, as they are all more or less the results of dodges worked by each individual workman. In some instances the sheet of paper, instead of being kept fist when marbling, is folded with a number of creases crossing each other, producing irregular waves, so to speak, in the paper. Again, a wooden frame, made of thin laths, may be made in regular squares or broken up so as to make circles or ovals. The paper to be marbled is damped and laid on the frame, and when being dipped the size forces some parts of the paper upwards, and when the ordinary wave-like motion, as when producing common Spanish marbling, is given to the design on the paper.

Rustic Table for Stage Use.—The illustration shows a rustic table for stage use, the top of the table heing formed of two pieces of 9-in. by 1-in. wood 4ft. long,



fixed together underneath by three battens lin. by 2imby 1ft. 6in. long. One batten is screwed in the centre and the others at 2 in. from the ends. The legs and cross-pieces are made from light tree branches. Round the edge of the table nall some smaller stuff or some strips of virgin cork. A suitable paint for the table can be made by mixing 1lb. of raw umber in powder with some hot size or liquid glue.

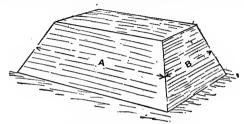
Darkening Oak Fretwork.—For darkening a fretwork overmantel made of oak without destroying the figure, a bichromate stain is used. Dissolve one pennyworth of bichromate of potash in 1 pt. of rainwater, then brush the article all over with raw linseed oil, using a painter's sash tool to ensure getting it well into all interstices. Now dip the same brush into the potash solution, brush the stain well in, and whilst still wet rub down with No. 0 glasspaper to cut down any apparent roughness. Brush over with the stain again, and wipe off any surplus with a rag. Excess of oil and stain should be avoided, and to counteract any tendency to twisting treat hoth sides alike. The above stain may be applied several times, and will impart an appearance of pollard oak. Should a still darker tone be required, use permanganate of potash instead of bichromate. During the operations it is a good plan to have the work apart, and laid down on a newspaper.

Taking Casts of Footprints.—Ordinary plaster would be found to make a suitable cast of a footprint. The plaster should be gauged fairly thin, so as not to disturb any peculiar markings, and gently poured over the footprint, blowing the plaster into every crevice. When completely covered, as much extra plaster may be added as will give the necessary strength to the cast. Give the mould a thin coat of oil, paraffin will do, before applying the plaster, so that the cast may be easily freed trom the mould. If the brushing-on of the oil is calculated to derange or damage the mould, the cast may be taken without it, only, in this case, the original footprint will be destroyed when freeing it from the plaster. If plaster is not handy, wax might be tried.

Gently melt down a few wax candles and, when cool, but before becoming hard, apply in the same way as plaster. This will make a cast that would be very easily destroyed or damaged, but, when the cast has once been obtained, it is a simple matter to make from it a plaster mould and recast it in plaster, or merely take a clay impression.

Lining Cask with Pitch.—A-cask whose inside is to be ceated with pitch should be made very hot by placing a small fire basket inside it. If the cask formerly contained turpentine or other inflammable liquid, care must be taken in heating the cask that the turpentine does not catch fire, as if it does the cask would probably be consumed. The pitch should be heated in an iron pot (care in heating is required, and the process should not be done in a house to prevent it catching fire) and then poured into the cask, which should be rolled round so that the pitch will flow over the whole of the surface. If the cask is to stand outside and hold rainwater, its outside can have three or four coats of ordinary oil paint.

Measurement and Weight of Coal Banks.—For ascertaining the approximate weight of coal stacked in banks with sloping sides and shaped as shown by the accompanying sketch, measure the length on a line taken halfway up A and the width on a line halfway up B and multiply one measurement by the other; then multiply the result by the vertical height, which may be obtained by placing a straightedge on the top to overhang one side and dropping a plumbline to the ground. For instance, suppose A to be 40tt., B 20 ft., and the height 5ft., $49 \times 20 \times 5 = 4,000$. Now to get the tonnage, divide by 40 for average coal, which would give 100 tons. When the heaps are not rectangular, take the average; for instance, suppose A to be 100tt. and the side opposite 80 ft., then the average, obtained by adding 100 and 80 together, and dividing by 2, would



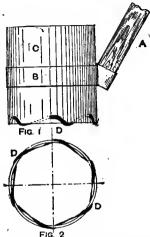
Measurement of Coal Banks,

be 90; the average width or height would be obtained in a similar manner. As coal varies considerably in weight, it is necessary to weigh trial lots from each colliery; this may be accomplished by finding the cubical contents of the coal waggons and dividing by the load after deducting the tare of the vehicles. It must be borne in mind that coal deteriorates both in weight and heating properties by being stacked in the open air for any length of time, and there is also a loss if the heap is weighed and removed in small quantities, but as these losses vary so considerably, according to the different conditions, it is not possible to state the percentage that should be allowed:

Acetylene compared with Incandescent Gas.—Acetylene gives a more natural light (that is, more nearly approaches daylight) than coal gas, and for this reason acetylene may, in a shop, he preferable to coal gas. But coal gas is much the cheaper, even allowing for new mantles, say four times a year. Light for light, as regards illumination, the cost of acetylene is equivalent to coal gas at 3s. to 3s. 6d, per thousand if Bray's hurners are used. When mantles are employed, the illuminating qualities of coal gas are so greatly improved (no additional gas being used) that the same illumination with acetylene gas would amount to nearly double the cost of coal gas, provided of course that the mantle burners are not covered with opal or other globes which reduce the light. When opal globes are used the cost of the two illuminants is more nearly equal. Another important consideration is that acetylene must be made on the premises; this involves a certain amount of trouble, though not much with a good generator. Added to this is the cost of the acetylene apparatus, and interest on this outlay should be calculated in the cost of the gas. Briefiy, acetylene is eneap and good, would abandon it for acetylene. In country houses, and in many villages, acetylene is superior to every other kind of artificial light; but in large cities coal gas is the cheaper light.

Determining Height of Cone for Ventilating Pipe.—The rule for determining the height of a rain-protecting cone above the top of a ventilating pipe is that the area of the cylindrical space between the base of the cone and the top of the pipe should be equal to the area of a circular section of the pipe. Thus, assuming the ventilating pipe to be 10^{11} in diameter, then 10×10^{12} equals 78 sq. in., the area of the end of the pipe. The circumference of the pipe is $10 \times 3\frac{1}{2} = 3\frac{1}{2}$ in. nearly. Dividing the area of the end of the pipe by the circumference (78 ÷ $3\frac{1}{2}$) equals $2\frac{1}{2}$ in. nearly. This would be the height at which the cone should be placed above the cylinder. A cone 6 in. larger in diameter than the pipe should he sufficient to prevent rain blowing down, and above and below a 10^{11} in pipe the size would be increased or decreased about $\frac{1}{2}$ in. in diameter for the cone for each difference of 1^{11} in the pipe.

Picker-up for Table Tennis Balls.—A picker-up for table tennis balls is constructed very simply. It consists of a light cane or stick A (Fig. 1) about 3 ft. in length, attached to a cylindrical tube of cardboard by a band of sheet-brass B so that the shank when fixed to the tube makes an angle of about 60° with the horizontal. The tube C is about 2 in. long and about \(\frac{1}{2} \) in. thick, and must have an internal diameter of 1\(\frac{1}{2} \) in. About \(\frac{1}{2} \) in. from the bottom of the tuhe, and at equal intervals around its circumference, are made six holes about \(\frac{1}{2} \) in. in diameter, and through these holes is threaded a piece of the narrowest flat elastic D, and the ends are knotted together. The elastic thus forms roughly



Picker-up for Table Tennie Balls.

a hexagon inscribed in the bottom of the tube, as in Fig. 2 and acts as a grip when the appliance is pressed on the ball, allowing the ball to pass into the tube but preventing it falling out.

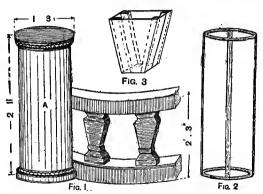
Blisters on Bramide Paper.—Blisters on photographic bromide paper very probably are caused by the uneven temperature of the solutions. The fixing bath should be made with warm water, as hypo becomes very cold while it is dissolving. All baths used in developing, fixing, toning, or washing should be kept as nearly as possible at 60° F. Prints that have blistered should be placed in methylated spirit, which destroys the blisters by causing the film to contract.

Hottest Point in Hot-water Appalatus.—Before the fire below the boiler is lighted, the water may be assumed to be of the same temperature throughout the apparatus. As soon as the fire is lighted, heated water begins to leave the boiler and passes up the flow-pipe; this shows conclusively that the hottest water is in the boiler. The case could not indeed be otherwise, for the boiler is the place at which the heat and the water are in juxtaposition. While the fire is kept going, the hottest point in the apparatus is the flow-pipe, tested as near to the boiler as possible, and obvious y the boiler is still ahead of the flow-pipe in temperature until all the water agrives at the boiling point, or until water is drawn from the taps. When the fire is let down or goes out, the heated water will gradually work its way up to the highest point in the apparatus at which circulation is possible, and the boiler will contain the coolest water until all the water is cool or until the fire is started

again. Nevertheless, when a boiler is heating up, it contains both the hottest and the coolest water. The hottest water leaves by way of the flow-pipe, but at the same moment the coolest water is entering the boiler by the return pipe. Heat is certainly lost from the flow-pipe unless it is well covered with some poor heat-conducting material. Such a covering is very seldom provided, and a practical observer always w nders why so much fuel and trouble are expended in heating the holler and so little care is taken to prevent dissipation of heat by unprotected hot pipes and tank, etc.

Removing Shininess from Black Cloth.—To renovate some black clothes that have worn shiny, it is necessary to spread the garments to be renovated on a plain press-board or table. Dissolve a little ammonia in hot water; in this dip one end of a stiff brush and work it vlgorously over the affected parts. This is best done by a jobbing tailor, but even when the renovation is carried out at home the garments should he sent to a tailor to be pressed. It should be said that when the "shine" is due to unusually long and severe wear the surface will have been worn beyond recovery, and no useful purpose will be served by the treatment that is described above. described above.

Balustrade and Pedestal for Photographio Studio.—Such articles as a balustrade and pedestal (Fig. 1), to be used as studio accessories in portrait photography, usually consist of a wooden framework, over which the ornamental part, generally made of moulded paper pulp, is fixed with glue; the whole is then coated with a mixture of whiting, lamphlack, and size. The accompanying illustrations will serve as a rough guide, but the maker of the article may of course vary the design to suit his taste. Figs. 2 and 3 show the method of building up the balustrade. The circular



Balustrade and Pedestal for Photographic Studio.

pillar is made hy winding good stout card around two hoops and laths as shown in Fig. 2; over this is moulded the pulp for the carving. The smaller pillars are made by glueing card round four stout pieces of wood; the other portions are cut and bent into shape in a like

manner.

Filling-up Bodies in Coachmaking.—For filling-np woodwork some coachmakers use spruce ochre ground fine in turpentine, whilst others prefer to use the Grafton filling-up powder, which is made of finely powdered shale and slate. If spruce ochre is used, to about 41h, add about 1½1b. of tub white-lead; this softens the ochre, and produces a closer surface; then add a small quantity of raw linseed oil, and the drainings of varnish cans, japan gold-size, and black japan, thinning the mixture to a cream consistency. The Grafton filling is mixed in much the same manner; thus, to a given weight of powder add from one-third to one-half the weight of tub white-lead, well incorporated with turpentine on the grinding-stone. Use a palette-knife for mixing. The body should first have three coats of light lead colour, and when it is dry and hard the filling-up is put on, one coat being applied each day, and successive coats being laid off in opposite directions. Six coats of filling are generally put on, but an extra coat is never wasted on a body. When the filling is hard, after standing a week or longer, a coat of Indian red or rose pink is put on as a guide coat when rubbing down. This is done with a level pumicestone and water. These, a sponge and chamois leather, and a No. 6 water tool to get the pumice dust out of the corners, beads, and quirks, are all the appliances required in rubbing down a body.

Polishing Briar-root Pipe.—Briar-root pipes often are oil polished, being wiped over with linseed oil, and polished by holding against revolving discs or a buff made of several layers of chamois leather. A steel burnisher is sometimes used. Ordinary French polish is unsuitable for pipes likely to get hot by smoking. One ounce of seed iac dissolved in 1 gill of methylated spirit and applied by a small piece of chamois will give a shipe that can easily be renewed as required. A trace of linseed oil applied at the same time as the solution will enable it to be spread more evenly.

Skeleton Sign Frame.—Figs. 1 to 3 show a skeleton sign frame 6ft. 6 in. long on each side by 3 ft. high, to take 10-in. by 6-in. wood letters. To make the frame, procure eight pieces of \$\frac{1}{2}\$-in. gas barrel, 6 ft. 4 in. long, screwed at each end, four cross pieces, and four T pieces; one end of each barrel should be heated and bent as shown and screwed into the cross pieces. On the other end of the two intermediates screw the T pieces. The top and hottom rails will require an angle piece at each end. The centre pillar is built up with short pieces of barrel, each 10\frac{1}{2}\$ in. long, connecting the cross pieces. Each wall pillar will be in one length, composed of a piece of round iron running through the two I pieces on intermediate rails and into the angle piece at each end. A hole is drilled through each piece and through the iron rod,

probably, however, the trouble will be found to be due to down-blow, for the smoke of one chimney is frequently driven down a neighbouring chimney if the latter is at the time without a fire. If the chimney is accessible, an experiment, to determine whether downblow is the cause of the trouble, can be tried by putting a piece of pipe on to a bedroom chimney not in use at the time; for a simple test a cardhoard pipe about 36in, high could be used. If down-blow is the cause, then probably the trouble only occurs when the wind is in certain quarters. If the smoke comes into the bedroom (the parlour fire being alight) without regard to wind or weather, then the trouble may be syphonage, which is the drawing of air down one chimney by the superior up-current in another chimney, the normal air supply heing insufficient for both chimneys. Syphonage is of rare occurrence in cottages, though common in very large buildings.

Finishing English Lever Watches.—Ronghly the process of finishing a t-plate English lever watch is as described below. The wheels are first pivoted, and the depths pitched accurately. The centre-wheel holes and fourth-wheel holes are taken as correct in the rough movement, and the barrel and the third wheel are pitched to suit them. When the wheels are run in the plates, the frame goes to a watch jeweller for

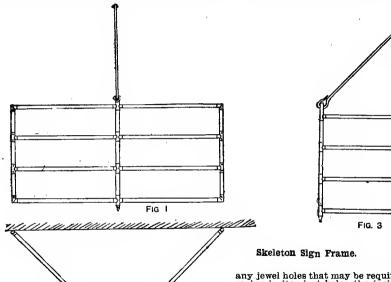


Fig. 2

which is fixed by a pin. Into the cross pieces at the top of the centre pillar is screwed an iron ring; the frame is fixed to the wall with four wall hooks driven in and clasping the pillar. As additional support is needed in the centre, the frame is suspended by a \(\frac{1}{2}\)-in. round wroughtiron rod, with a hook at each end; one end is fastened through the ring at the top of the centre pillar, and the other end through a ring driven into the wall. The wood letters are fixed at the top end with wrought-iron plates to iron rails, and are allowed to swing, or they may be fixed permanently on wire frames, which are in turn secured to the frame already discribed. Figs. 1 and 3 are elevations and Fig. 2 a plan of the frame.

Trouble with Chimney.—It sometimes happens that when a fire is lighted in one room of a house, smoke is discovered coming out at the fireplaces of other rooms. In a new house the trouble can scarcely be due to defective brickwork; and even when in old huildings the sweep has knocked out a brick or a hslf-brick between two chimneys, the effect is seldom to cause smoke to rush out in the manner described. A simple experiment, however, that will prove whether a chimney is sound may easily be tried. Light a fire in the grate of the suspected chimney and then put a sack over the chimney top; if the smoke comes out at any unexpected place the defect will be at or near that place. More

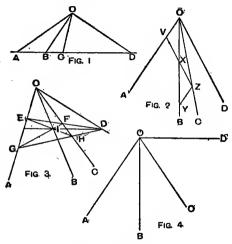
any jewel holes that may be required. The barrel needs easing in its pivot holes, the inside of the bottom and cover must he stoned smooth, a mainspring hook should he fixed, and the stopwork must be made to work easily and smoothly. The set-hand work is made to work properly, and the motion work turned to fit and run correctly. The belance cock is sent to be engrayed, and the index and hairspring stud are made and fitted. The winding squares are reduced in length and polished. All the screws are hardened, tempered, polished, and blued. The plates and cocks are stoned up, sent for any engraving they need, and then forwarded to the gilder. If the plates are to "he spotted," they are done in a spotting tool. This consists of an upright spindle which is revolved by a foot wheel or by a bow; it carries a small ivory tube, like a drill, underneath which is a movable table to which the watch plate is fixed. This table has two motions, worked by screws like a lathe slide-rest. The plate is first polished, then smeared all over with a thin paste of oilstone dust and oil and placed on the tool. The spindle with the ivory tube is revolved and made to touch the plate for a moment; the plate is then moved one division by the screws, and the process repeated until the complete pattern is made.

Mending Umbrella Tube.—A steel umbrella tube

Mending Umbrella Tuhe.—A steel umbrella tuhe broken at the notch should have a new tube. However, to repair, remove the tuhe from the frame, then geta piece of round iron rod about 3 in, long and of such a diameter as will tightly fit the iuside of the tube. If the tube is a thick one, possibly a piece of an old thin tube may be procured that will fit. Push about 1½ in, of this dowel piece inside the tube and put a fine rivet right through, then fix on the end piece in the same way. The notch will best be refixed by soldering, as drilling a hole in the tube will weaken it.

Silver plating Paste.—Cheap silver-plating pastes and powders are useless and really harmful; they are generally made from mercury compounds, and the mercury amalgamstes with the metal on which the paste is spread; then in a few days the bright surface becomes tarnished and the metal becomes honeycombed and dull. The best material to use is a silver compound. A silver-plating powder may be made by mixing together with a little water 1 oz. of chloride of silver, 3 oz. of common salt, and 2 oz. of cream of tartar: this should be rubbed on the articles to be plated. If this preparation is too expensive, a silver bronze paint could be used; this could be made by rubbing up aluminium powder with sufficient pale copal varnish to form a stiff paste and thinning out with thregutine.

Harmonic Pencils.—The harmonic pencil cuts any transversal AD (Fig. 1) harmonically; that is, AB: AD: AC-AB: AD-AC, which can be seen by a simple measurement, as AB is one-fourth of AD. Let OA, OB, OC, three rays of a harmonic pencil, be given (Fig. 2); it is required to find the fourth. Take X, any point in OB, and make XY equal to OX. Draw YZ parallel to OA, and ZX produced to Y through X. Then VZ is bisected at X. Draw OD parallel to VZ. This is the fourth ray. This method depends on the fact that if a line is bisected by a ray, it is parallel to the conjugate of that ray. (Alternate rays are conjugate to one another.) A second method is as follows (Fig. 3). Given OA, OB, OC, as



Harmonic Pencils.

before, draw any line EF and produce it. Take any, point I in OB, and draw FIG and EIH. Draw through GH to meet EF in D. Then OD is the fourth ray. The proof is this. Take a quadrilateral, as EFGH. Draw the diagonals, which intersect in I. Produce the opposite sides to meet in O and D. Join OD, OI, and DI. Then the pencils which radiate from OX and O are both harmonic. If OB bisects the angle AOC, OD is at right angles to OC (Fig. 4).

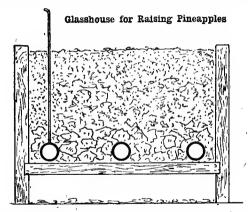
Groyne.—A groyne is a wall or breakwater built on the sea-beach, extending from high-water mark towards low water, and serves to prevent the sea washing away the land. The groyne schieves this purpose by preventing the travel or drift of the sand or stone that forms the shore. The Case groyne is made of timber, and the theory of the inventor of this form of groyne was that the work would be better done if done by slow degrees. This groyne is made only a foot or two high at first, and when the sand or gravel has been accumulated to the full height of the groyne another foot or so is added. This theory has been found to be correct, and as a consequence the Case groyne is now nearly always used to prevent the sea making inroads.

Cresylic and Salicylic Acids.—Cresylic acid (C_7H_8O) is a colourless liquid substance principally found in coal and in the products of coal tar, and also it is found in firwood tar; on repeated distillation cresylic acid yields phenol (carbolic acid). Nitric acid acts upon cresylic acid, forming nitro-cresylic acid. A considerable quantity of cresylic acid is employed in the manutacture of salicylic acid, which, possessing several advantages over cresylic acid, has superseded it for all

the purposes for which cresylic acid was formerly used. The addition of a little salicylic acid renders all kinds of glues very tenacious and prevents decomposition, this property being taken advantage of by manufacturers of distemper. Salicylic acid is quite colonrless and free from taste or smell, and is considered to be three times more powerful than carbolic acid in preventing putrefaction. Skins that are to be used for making leather do not undergo decomposition if treated with dilute salicylic acid. Salicylic acid is poisonous in quantities.

Blisters on Preumatic Tyres.—Dirt between rubber and canvas causes blisters or swellings. To remove them, hook a piece of wire, push it through the rubber, and scrape out the dirt. Put some rubber solution in through the hole, and work round with the wire. When dry, press the rubber down to the canvas while inflated.

Glasshouse for Raising Fineapples.—For growing plueapples in artificial heat practically any shape and size of greenhouse will be suitable, provided it can be kept hot enough. 'A broad lean-to kind is the best, as its side wall can be put to face the north and thus save anxiety when the cold gales are on, for the pineapple is very delicate and susceptible to the least fall in temperature. A pine house should have other glasshouses at each end to shelter it and so that its doors may not open to the outersir. A temperature of 80° F. is required, and to obtain this there must be 75° ft. to 80° ft. run of 41n. pipe to each 1,000 cub. ft. capacity in the house. An exposed situation may require 85° ft., while for a naturally warm situation 70° ft. per 1,000 cub. ft. night suffice. Pines are raised in "pits." These are beds resembling huge wooden troughs raised off the ground a little. These pits vary from 2 ft. to 5 ft. wide, and may be as long as desired.



dently of the house, by pipes run along in the hottoms of the beds as shown by the illustration, which is an end section of a bed. Two 4-in, pipes see enough for a 3-ft, bed, while three 4-in, pipes would be required for a 4-ft, bed. The pipes are covered with clinker or broken brick, then comes a layer of smaller stuff, then the earth above. The rough material drains the bed and prevents the earth getting round the pipes. Some beds have the pipes underneath the bottom, while others have a long brick-built tank underneath, and the pipes are run through this. It is also a good plan to let one of the house pipes run round the top edge of the pit. The degree of hundidity is a matter for the grower to decide. The moisture is obtained either by running one or two pipes through a long trough of water, or trough pipes are used. The latter are pipes with troughs cast on them. Or loose troughs to lie on top of the ordinary pipes can be had from all pipe factore, or zinc troughs can be made.

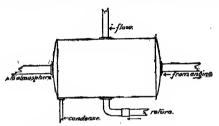
Walnut Varnish Stain.—For a walnut varnish stain, agitate 1 pt. of methylated spirit and 3 oz. of orange shellac in a well-stoplered bottle at intervals until thoroughly dissolved; then add loz. of Bismarck brown and loz of nigrosin, stir well, and pass through a fine strainer, when the stain is ready for use. By varying the proportions of the colouring matter any shade of cak or walnut may be prepared. In reply to a further question, cil is not used in spirit varnish, the medium employed for thinning down being methylated spirit. The stickiness complained of is due to the varnish being too thick. The varnish should be applied quickly and evenly in a warm atmosphere, using a wide camel-hair or sable brush

Naphtha Varnish.—Wood naphtha or crude wood spirit is very little used in spirit varnishes on account of its complex composition. To prepare a varnish from wood naphtha, place I gal. of naphtha in a well-stoppered vessel with 21b. of bleached shellac, and dissolve by frequent agitation; allow to stand for fourteen days, when the varnish will be ready for use. By adding aniline dyes soluble in spirit, the varnish may be converted into mahogany, walnut, and other stains. The above preparation will be found to evaporate very quickly, and therefore it should be kept in an air-tight vessel in a cool place.

vessel in a cool place.

Sugar Candy.—Sugar candy is prepared from a saturated solution of sugar, formed by adding sugar to boiling water till it will dissolve no more. The solution is then run into troughs, in which it is allowed to cool slowly, while a number of threads are hung in the liquid upon which the crystals form, and continue to grow. The time required will depend on the bulk of sugar treated. In working on a small scale, it will be necessary to remove the strings and adhering crystals; then add more sugar to the liquid, boil up, and immerse the strings again while the liquid is cooling. Cakes of candy will also sepurate on the sides of the vessel in which the liquid cools.

Heating Water by Exhaust Steam. — To utilise exhaust steam from a 12-horse-power engine to heat the water of a hot-water circulating system which is at present heated by a boiler in the usual way, either the water could be heated by the steam alone or the steam could be made to assist the present ordinary boiler. The method to be adopted is that by which feed-water is heated, and a modified form of feed-water heater is suggested. A cylinder with a set of tubes in it is the best heater for the purpose, the steam being either outside or inside the tubes, whichever arrangement appears better



Heating Water by Exhaust Steam.

If it can be arranged, it is best to let the exhaust blow straight through the heater, but it should first go through a "separator," which removes the oil. In summer-time there should be a means for the exhaust to escape without going through the heater. The heater must have a condense pipe from it terminating in a trap. The accompanying sketch shows these details. The flow and return water pipes only require to be joined up to the existing mains, flow to flow and return to return. There should be a safety-valve on the water part of the heater.

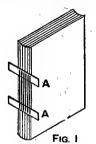
Black Cream for Boots.—For a black cream for hox calf hoots, mix 11h. of curd soap, 21h. of heeswax, 21h. of oil of turpentine, and 42 pt. of water, with black or any colouring matter to the shade required. Cut up the soap, and dissolve in water by holling separately; dissolve the wax in the turps by heating the two together, pour into the soap solution, and briskly stir until the whole is cool and creamy. Aniline colours, if required, should be mixed with the water before the soap is added.

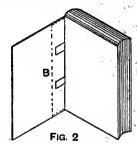
cleaning Geneva and Waterbury Watehes.—All watches are cleaned by being taken to pieces, the parts being immersed in benzine for a few minutes to dissolve the old oil, etc. They are then held separately in tissue paper in the fingers (to avoid handling) and brushed clean and dry with a soft "watch brush" rubbed in dry chalk. All pivot holes, etc., are thoroughly cleaned out with a sharp-pointed peg of wood (sold in bundles as watch "peg wood"). To clean jewel holes that have endstones, the endstones are taken off before pegging the holes. Before taking any watch to pieces, the mainspring must be let down by holding up the winding click and allowing the spring to run back by means of a key placed on the winding square or by the winding button. While taking to pieces, look carefully for faults, such as worn pivots, wide pivot-holes, signs of wheels rubbiug on the plate or against each other, etc., with a view to correcting them before putting together again. In a Geneva watch escapement the cylinder must be of such a height that the 'scape wheel enters the slot or passage cut for it without touching

either the top or the bottom. The depth must be aufficient just to allow the 'scape-wheel teeth to "loek." The watch should be accurately "in beat"—that is, when the balance is at rest, the cylinder opening should face the 'scape wheel exactly. A Waterbury is a duplex watch, and is in beat if, when the balance is at rest, the impulse-pin points to the 'scape wheel. Oil should be placed in small quantities on mainsprings, ou all pivots, on keyless wheels and springs, and on the points of 'scape-wheel teeth.

on keyless wheels and springs, and on the points of 'scape-wheel teeth.

Binding Books Without Special Tools.—For binding books without special tools all the materials that need he provided are a little meited glue, some paste, a needle and stout thread, some white and coloured papers, and a few other trifling items. Arrange the sheets to be bound in order, beat them even at the back and head, and subject them to a heavy pressure between two flat surfaces by pilling weights on them. Now take two pieces of tape in. wide, and each 2 in. longer than the width of the back of the book. Stiffen the tape by drawing it through paste, and then let it dry hefore use. Fold the pieces of stiff tape, and place the sheets within them in such a position that the two tapes a (Fig. 1) will divide the back into three equal lengths. While the sheets are pressed down irmly with the left hand, with a lead pencil draw a line down each side of the tapes, and two other lines, each one dividing that part of the back outside the tapes into equal portions. These lines mark the place for the entrance of the needle. The sheets are to be sewn on the tapes as in Fig. 1. When the book is sewn, the threads fastening each sheet are seen outside the tapes. The back must now receive a coating of glue, not too thin, after which it may be left to dry. Then, the glue being hard, the book may be cut on the edges with a straightedge and a sharp knife. The back must next be rounded by tapping with a hammer, which may be





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Binding Books without Special Tools.

helped by a gentle pulling at the tapea. For the covera, use the thinnest millboard. Cut two pieces of this to project about in. over the head, foot, and fore-edge of the book, and glue them in position on the projecting tapes, which will adhere to their inner sides. Over the tapes glue strips of coarse canvas B (Fig. 2), each strip being I in. wide by 6 in. long; then glue on the open back. When this glue is dry the volume may be covered with paper, eloth, leather, or vellum. Vellum must he lined first with clean white paper firmly pasted on it, and cloth covers must be fastened with glue; instead of glueing the tapes to the boards, cut a cloth cover large enough to allow for overlapping and for the width of the back, glue the covers on the cloth parallel with each other, and turn in the cloth round the edges. When this is dry, the book may be placed in the cloth cover, the tapes glued to the inner sides, the open back to the back of the cloth, and the strengthening canvas glued over the tapes; finally, the end papers being fastened down, the volume is fluished. It will look a homely affair, but it will cost little beyond the trouble and will effectually preserve the volume. For many volumes published in numbers, the publishers supply covers; these may be securely fastened ou by this simple method.

these may be securely fastened on by this simple method.

Electro-platers' Stopping-off Varnishes.—Best copal varnish is a good stopping-off varnish suitable for all-round purposes by electro-platers; after application, it should be allowed to dry for three hours, until it has got quite hard. This will stand the action of hot or cold cyanide solutions, and may be removed by the application of warm methylated spirit afterwards. An indication of its presence may be secured by tinting it with ultramarine or one of the aniline dye stuffs. Common varnishes may be employed in cold solutions, or a stopping-off varnish for use in cold solutions may be made as follows:—Place some crushed best red sealing-wax in a bottle coutaining naphtha, and stand the bottle in hot water until warm, then well shake the mixture until the sealing-wax has dissolved. Apply with a soft brush.

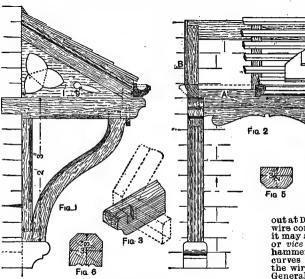
Design for Bracket to Verandah.—The accompanying illustrations show the end view (Fig. 1) and front views (Fig. 2) of a verandah supported on brackets; such a verandah is suitable for a small villa or cottage executed partly in half-timbered work and having a ground storey hay window projecting I ft. 9 in. from the main wall. The rafters, out of 3-in. by 2-in., are fixed at the top end to a ridge-piece nalled to the wall and at the bottom, birds-mouthed over plate A housed into the ends of the bracket heads, and rests upon and forms the head of the hay window. The housing may be simply a plain notch half the depth of the plate and nailed, or it may be rendered additionally secure by dovetail notchings, as shown in Fig. 3, where the head of the bracket is shown in full line and the plate and end rafter in dotted lines. The end rafters are kept flush with the outside of the bracket, and, if desired, the spandrel may be filled in with a ½-in. perforated panel as shown. This panel should be placed lying and grooved ½ in. into the rafter and head; the design of the perforation is based on the equilateral triangle, as shown by the dotted lines, and is easily described by bisecting the angles of the spandrel to find the centre lines of the arches. The brackets are mortised and tenoned together as shown by dotted lines, the tenons being painted and the foot of the rib screwed to the wall piece; the latter is fixed to plugs in the wall, 4 in. being sufficient to insert the head into the wall, building in with cement. The gntter is worked in the solid out of 3½-in. by 3-in, pitch-pine and screwed to the plate, the end heing returned

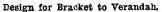
brush kept for the purpose, and an undercoat of varnish put on; this should take two days to get thoroughly dry, and is flatted, as for the coat of glaze, with a pad of cloth well wet with water and fine pumics powder, washing off well so that no dust is left on the body or in the corners, for which a water tool should be used. The finishing coat of varnish is then put on in a clean, well-lighted shop, and in winter kept to a heat of 70° F. Sometimes blue and vermilion lines on carriages are glazed to produce a higher tint. As regards polishing a carriage, the work must stand at least six months hefore polishing is attempted.

Cleaning Watch Hairspring.—The correct method of cleaning a watch hairspring is to dip it in benzine and dab it dry on tissue paper several times in succession. Then remove any dirt that remains with a pointed watch peg.

watch peg.

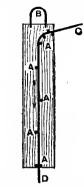
Straightening Wire.—The illustration shows a block used for straightening wire, the method employed heing understood easily. It is simple in construction, consisting of a block of wood 3 in or 4 in. square and about 1 ft. 6 in. long. For the pegs A strong wire nails or pieces of wire may be used. To make the apparatus, first bend the wire CD to shape, lay it on the block, and knock in the nails or pegs as at A. The wire should be of the same thickness as that to be straightened. The loop of wire B is knocked into the block so that the latter may he fastened to the bench. Having made the block, the wire CD should he taken out and the wire to be pegged put in similarly to the wire CD. The wire is then pulled





in the solid as shown in dotted lines (Fig. 2). The covering of plain tiles may be fixed to hoarding or hattens as shown; in the latter case a verge piece B is cut to fit under the tiles and cover the ends of the battens, finishing behind the gutter. A shaped apron lining (C, Fig. 2) is shown grooved into the under side of the plate and honsed into the brackets, but, if desired, may be nailed direct on to the face of the pate, which would then he kept the thickness of the lining farther back. Figs. 4, 5, and 6 are respectively enlarged sections of hracket head, wall piece, and bracket rib. Figs. 1, 2, and 3 are reproduced to a scale of \(\frac{1}{2} \) in to the foot, and Figs. 4, 5, and 6 are one-ninth full size.

Glazing in Coach Painting.—In any good job in coach painting it is the trade custom, when the body or carriage has been brought up to the itrst coat of the proper ground colour (which should dry in ahout eight to ten hours) to apply a second coat to make the first coat solid. In the third coat a good proportion of undercoating varnish should he mixed with the colour; this is called the glazing coat, and is put on to prevent the varnish on the body or carriage being absorbed hy the undercoats of colour. The coat of glaze should stand for a day or two to get hard, and is then flatted for the next process of lining out, which requires for a good job a smooth, even surface. After the lining-out is done and dry, the work should be dusted off with a camel-hair



Pegging Block for Straightening Wire.

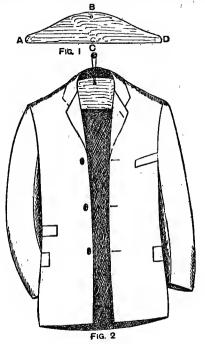
out at D. Some little experience is necessary to make the wire come as straight as required. In pegging the wire, it may at first come out of the block curving to the left, or vice versa. To remedy this, tap the pegs with a hammer to the left or right as required; thus if the wire curves to the left, tap some of the pegs to the right; if the wire curves to the right, tap the pegs to the left. Generally, the pegs will be found to control the straightening of the wire. The worker, whilst he is drawing it through the block, should get an assistant to hold the coil of wire. If it is wished to peg different sizes, several blocks should be made, say one for Nos. 11, 12, and 13 B.W.G., and one for Nos. 16, 17, and 18 B.W.G. In practice a separate block is kept for each two sizes, but where only a small quantity of wire is required, one block may be made to do for several sizes.

Fretwork.—In executing fretwork first draw out

Fretwork.—In executing fretwork, first draw out the design full size, then inscribe the pattern selected, leaving a sufficient margin around the edges of the design to give strength where most of the weight hangs from. When the designing is finished, slightly shade the parts that are to be cut away, using Indian ink mixed with a little water. Next the whole should be inked in and then traced to save the design. The wood should then he planed to a smooth surface and the traced copy should be pasted on the board with thin paste. Before cutting out, to admit the fretsaw bore holes with a small gimlet in the centres of the parts that are to be cut away, leaving the outside edges until last, as the work is liable to snap in the centre. Then commence on the outside water pieces and serve them the same way, working with very great care. After all the necessary parts are cut away, the fretwork should be held horizontally with the face downwards over a steam-kettle for a few seconds only; this releases the paper left on the fretwork surface, which should afterwards he ruhhed very lightly with sandpaper. Then when the connecting parts are fixed together, the wood will he quite ready for varnishing.

Starches for Laundry Work.—Ordinary starch for linen usually is the same whether made with hot or cold water; hut used cold it does not give such a stiff finish as the boiled. For sizing starches are made that break down even in cold water; these, of course, are different from ordinary starch. The usual starches sold for laundry purposes are maize (Indian corn) starch and rice starch, and for sizing purposes potato starch and sago starch, starch is made from potatoes by rasping and washing them through fine sieves; the starch separates from the wash waters and, after several washings and settlings from pure water, is drained, dried slowly, and broken up. The other starches are similarly made, but hard materials like Indian corn or rice have first to be fermented or else treated with alkali in order to break them down.

Coat Suspender. — The bagging of a coat collar is generally due to hanging the coat by the ordinary neck loop, and the heavier the coat the more certain will there be the loss of form, which will become evident in time. It is usually wiser to employ a coat suspender, of which several varieties are in the market. A simple,



Coat Suspender.

effective, and inexpensive one may be made as shown in Fig. 1, using wood from \$\frac{1}{2}\text{in.}\$ to \$\frac{1}{2}\text{in.}\$ to \$\frac{1}{2}\text{in.}\$ to \$\frac{1}{2}\text{in.}\$ to \$\frac{1}{2}\text{in.}\$ and the top edge on which the shoulders of the coat are to rest should be rounded to avoid "ridging." A hole is drilled about 1 in. below B as shown, and through this is passed a string for attachment. Fig. 2 illustrates the suspender in use; it greatly helps to retain the form introduced by the tailor.

Gilding Cardboard Mounts.—When picture mounts of cardboard or similar stuff have been cut out with a bevel edge the only practical method of gilding this edge is by covering it with gold paper. Paper for the purpose, called gilt binding paper, can be had from most stationers or mount cutters. Strips of this paper are carefully cut to size, pasted, put on the bevel, and turned in to the back. Special attention must be given to have the corners neat and to prevent the given to have the corners neat and to prevent the join from being unsightly. Such mounts are, however, often gilded before being cut out, but this process is beyond the amateur. A blocking press, three brass blocks, and a shaped steel cutter, will be required. One of the brass blocks is simply a frame, which may be of any shape; this is set up in the press, which is heated. The cards are prepared with the necessary size and gold leaf and blocked in the press, and when the surplus gold is wiped off a broad line is left on the board. The second brass block is simply a flat piece of brass smaller than the frame each way by the size

of the bevel, say about \$\frac{1}{2}\$ in. The third block is a larger frame than the first, and has a little larger opening. The three blocks couprise a set. When the gold line or frame has been blocked on the card, the block is removed and the second or solid block is set up. The large or third frame is arranged on the bed of the press. The card is next placed between these two blocks, and when pressure is applied in the usual manner a deep impression is made, which will bevel the glided portion, and the card will have the appearance of a flat tray with a gold border. Then the steel cutter, of the exact size of the block which makes the depression, removes the centre. The various blocks and the cutter must suit the work to be done, and if the blocks do not register with each other, very imperfect work will be produced. For gilding the surfaces of picture mounts, follow the instructions given in Series I., p. 108.

Glossing Stiff Felt Hats.—A gloss for felt hats

mounts, follow the instructions given in Series I., p. 108. Glossing Stiff Felt Hats.—A gloss for felt hats may be made by diesolving 1 oz. of shellac in ½ pt. of methylated spirit and for any desired colouring add aniline black soluble in spirit. This should be applied sparingly with a rag and the hat then ironed, but the hat itself should not be held over the stove. Another method ist place a piece of beeswax on a soft piece of flannel, and iron the wax into the flaunel with a hot iron. While the flannel is warm rub it all over the hat, and then iron the hat; finally polish with a felt pad. These methods should be tried on an old hat first until experience with them is gained. Further information on reviving felt hats is given in Series I., p. 286.

Washing Trough for Laundry.—Pitchpine is the best timber to use in the construction of laundry wash-house joinery. For a trough 8 ft. 10 in. long, 1½-10, stuff, finished size, should be used. The sides should be in two pieces, ploughed and tongued, the bottom being screwed on with brass or galvanised screws. Let the centre pieces and ends into the sides about ½ in., and fasten the whole



Washing Trough for Laundry.

together with galvanised plates A and bolts as shown in the illustration.

Platting Whip Lash.—For a four plait whip lash cut the thougs, leaving them together at one end for 6 in. for a keeper; cut that to a point, and cut the thougs narrower and pointed towards the other end; turn the keeper down so that it can be plaited over, and get a firm hold of it inside the lash. Then take hold of the most outward thong on the left-hand side, and draw it between the most outward thong on the right hand and the next to it; pass it over to the left, then take the extreme right-hand thong and draw it between the extreme left thong and the next to it and pass it over to the right, and so on till the plait is finished; keep the thongs flat, and roll the lash with good weight when finished and put over it some powdered chalk.

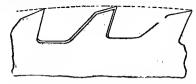
Cutting and Polishing Sections of Rock.—For a simple revolving cutter and polisher for sections of rock that could be attached to the table of a treadle sewing machine some special contrivances would be necessary. A second-hand headstock could be purchased and receted over the pulley wheel of the treadle, and a three-screw chuck obtained to suit the nozzle. In this chuck would be fastened the stick-brass to which would be attached the cutter; this consists of a steel disc about \$\delta_i\$ in thick. Alongside the cutter should be improvised a rest, on which the rock is placed, and so pushed up against the disc as it revolves. In the process of cutting, diamond dust moistened either with turpentine or paraffin is applied both to the cutter and the rock. Diamond dust can be obtained from dealers in Hatton Garden, London, E.C. A cutter made as above is the best and quickest used. A cheaper method is to use a disc of copper and medium emery powder moistened with turpentine. In this case more than one disc would probably be needed. For polishing the rock, an emery wheel would take off the worst of the roughness, and then the polishing process would commence. The specimen is ground on a flat surface with varying grades of emery powder until the very finest is reached, and then the final polish is given either with rouge or putty powder, this last polish being given on a smooth steel surface plate.

Lithium.—Lithium le somewhat similar to alum in appearance. When freshly cut it looke like silver, but readily tarnishes in contact with air, becoming slightly yellow. It is soft and weldable and melte at 18 °C. It is the lightest colid known—lighter than any known liquid. It is oxidised by water, so it is necessary to protect it from the air by keeping it in naphtha. It has no application such as has aluminium in manufacturing nurnoses.

white-lead Paint for Inside Work.—For a secondcolouring coat for inside work, make white-lead paint
thus. Procure 14lb. of genuine white-lead and ½1b. of
patent driers and thin down with equal parts of linesed oil
and turpentine. Second coats on old work should always
te mixed with an abundance of turpentine, otherwise the
paint will not adhere firmly. After the second-colouring
coat has been applied, the work should be carefully
stopped with a putty made from white-lead, gold-size,
and turpentine mixed to a paste, and then rubbed down
with No. 0 sandpaper until a perfectly smooth surface is
obtained. Another coat should then be applied, using
one-third oil to two-thirds turps. Rub down as before,
and apply a coat of varnish colour made hy mixing
together white-lead ground stiff in turpentine and
thinned down with French oil varnish. If a high-class
finish is required, rub down with a felt block and flour
pumice powder and apply a finishing coat of French oil
varnish. When finishing with white varnished colour,
lay the paint off as evenly as possible, taking care to
obliterate all brush marks when finally laying off.

Form of Saw Teeth for Cutting Hard Woods.—

Form of Saw Teeth for Cutting Hard Woods.— A suitable form of tooth for hard woods is shown in the accompanying sketch. For cutting unseasoned



Form of Saw Teeth for Cutting Hard Woods.

timber the lead of the teeth should be at an angle of about 70°. The transverse bevels should be at an angle of about 10°. For cutting dry or seasoned timber the angles should be less acute. From sixty to sixty-six will be a suitable number of teeth in the saw.

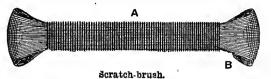
Slate Cardboard.—There are several ways of preparing enamelled writing surfaces on cardboard. The following is a method now much in use. A mixture of white or bleached shellac and borax is dissolved in 10 per cent. of water; concentrated glue size and mineral black rubbed to an impalpable powder is used for the first colouring material. In large mills the colouring material is transferred to the paper which is to be coated by means of specially constructed felt rollers and evenly distributed with brushes. The paper is then dried and rolled up. Another coat, which differs somewhat from the first and which consists of vine-black, glycerine, glue, and water, is then applied. In some cases, where a good quality is required, two or three coats are given, after which the paper is dried and cut up into suitable sizes and steamed at a temperature of 250°F, and finally smoothed by calendering (or drying through steamheated rollers). The simplest method would be to mix equal quantities of flour emery and ivory black in white hard spirit varnish and apply with a wide camelhair brush in a warm temperature. The addition of a small quantity of caster oil will give greater eleasticity and prevent cracking. and prevent cracking.

use of Galvanised Pipes.—The process of galvanising consists of cleansing the metal and dipping it in molten zinc. An idea prevailed at one time that the cleansing process was effected with acids that had a destructive action on the metal, but no such danger need be feared now. Therefore, the process is a strengthening one, as galvanising tends to make the metal a trifle thicker, and cleans the dirt out of the weak places and fills them with zinc. The generally recognised reason for galvanising iron goods is to prevent the iron rusting, and this preventive method will succeed if the water carried in the pipes does not attack zinc. In London, the waters are all hard, and the presence of lime prevents the water attacking iron and lead, so that the rule in London is to use plain iron pipes for hot-water work and lead pipes for cold water, and the iron pipes but very rarely give any trouble hy rusting. In many places in the North of England the water is soft, and attacks iron and lead; in these cases nothing is gained by galvanising the iron pipes, as the water attacks zinc just as freely as lead and iron. In

other words, when iron pipes are attacked by the water passing through them, galvanising the pipes seldom proves a remedy, as the majority of waters that exert a destructive influence on iron are destructive of zinc also. Notwithstanding this, the use of galvanised pipes and fittings is desirable, for with slightly hard waters (and under several other conditions) the protection afforded by the zinc (if lasting only for a little time) allows the pipe to get into a condition which prevents rusting. Malleable-iron fittings rust nearly as fast as wrought-iron, but are not so destructively affected, heing, in this respect, like cast-iron.

Gilding Military Braid.—For electro-gilding military hraid, a cage must be made of non-absorbent hardwood, say lancewood. The braid must be lightly wound over this cage, with each fold side by side, but not crossing. The folds should then be interlaced with fine whre at two or more points of the cage, to conduct the current rapidly to all parts of the braid and thus prevent blotches in the gilding. A length of No. 24.8 W.G. copper wire should then connect all the other wires and form the slinging wire. First wet the whole in distilled water, then lower into the gilding solution (heated to 170°F.), and gild with a current of low voltage to prevent browning. When gilded, well wash in hot water, dry before the fire, and brush with a hair brush. Re-gilded braid rarely attains the lustreef new gold braid.

Scratch-brush.—A scratch-brush (see illustration, which is two-thirds full size) is made of fine steel wire bound with stout brass wire, as shown at A. When using the brush the end marked B must be cut across. The scratch-brush is of use in removing rust from gun-barrels, etc., but beginners are advised to start



with a piece of scratch-card, as scratch-brushes are rather dear.

Casting Small Metal Teapots.—One method of casting metal teapots is described below. A brass mould, in two halves accurately fitting and smoothly finished inside, must first be made to the size of the teapot required. The moulds must be heated till only slightly cooler than the alloy being used, and well covered with a thin coating of lampblack and turpentine. Fix the two halves together and run in the molten metal. (After a little practice the time can be very accurately gauged.) After allowing the metal to remain till a thin crust has set, turn the mould upside down and run out the metal, which will still remain liquid, from the inside. The inside, while still in the mould, may be hurnished to remove roughness if considered necessary. On separating the mould the teapot will be found to have a smooth and fine finish. The best alloy to use is one consisting of about 91 parts of tin to 9 parts of antimony. If the metal does not run as smooth as required (which will be readily seen after casting a few articles), add metallic bismuth, not exceeding 1 per cent. This increases the fluidity of the metal. The teapots can be finished under the polishing beb.

Coach Painters' Sandpaper Stopping.—Sandpaper

Coach Painters' Sandpaper Stopping,—Sandpaper stopping is made by mixing colouring matter, as lampblack or drop black, and white-lead with turpentine 3 parts, gold-size 1 part.

Sparts, gold-size I part.

Extracting Fat from Meat.—In extracting the fat from a quantity of rough meat and bones, the meat should be heated together with a small quantity of water in a digester that is fitted with a safety valve and a pressure regulator. The temperature can thus be raised to above ordinary boiling point by putting on 51b. The liquid containing the fat in suspension should be run out into a shallow tank or bowl and allowed to cool; the fat will then pass to the surface and solidity, and may be readily removed. At the same time, all the soluble nutritive material of the meat will be dissolved out by the water, and unless utilised in some way would be wasted. It may be used either by drying it down on the meat fibrin left insoluble, or by Incorporating it with other food. For instance, the meat fibrin may be mixed with barley or other meal, the liquid from the digester added, kneaded in, and baked into cakes, which may be ground to powder in a disintegrator, forming a very nutritious meat meal. If it is only desired to dry the Insoluble fibrin, this may be done on trays in an oven. done on trave in an oven.

Measuring Lead on Dome.—The simplest plan of measuring up the lead on a dome is to measure up the superficial area of the dome, and add to that sum sufficient to account for all rolls and passings, etc. To find the area of the dome, assuming that it is a true hemisphere, the rule is: diameter of base × 8:1416 × vertical height, Example: A dome 20 ft. in diameter, and covered with 7-lb. sheet lead; $20 \times 3:1416 \times 10 = 628:32 \text{ super}$, ft. This dimension × 7 = 4398:21 lb, = weight of lead on the dome. On such a dome would be about twenty-six rolls, running from the enves to the spex; and each roll would require a strip of lead 8 in. in width. The length of the rolls would be $(20 \times 3:1416) + 4 = 15:7$, or say, 15:ft. 9 in. × 8:ft. × 2:ft. × 7 lb. = 1911 lb. Added together = $4938:24 + 1911 = 6309:24 \cdot 1b$, or 2:ft. tone 16 owt. 2:ft. lb. = the total weight on the dome. Any horizontal laps or passings, owing to the bays being put on in two or more pieces, would have to be allowed for, and the extra weight added to the above total. A further allowance would have to be made if it were intensed to fix an apron round the base, or any ornament or finial on the apex. Measuring Lead on Dome.-The simplest plan of

on the apex.

Charging Syphon.—Fig. 1 shows a simple method of charging a syphon, when the perpendicular height of the shorter leg does not exceed 25 ft. or 26 ft. The well B is supposed to have about 3 ft. of water. 0, the point where the water is wanted, may be any distance from the well, but must be below the level of the water. A pipe, with a screw-cap H, is soldered to the highest part of the bend, and made perfectly air-tight with a leather washer. For a large syphon a flange and cover should be used instead of a screw-cap. The syphon is charged by removing the screw-cap and pouring water in until the syphon is full. This must be done gradually to

S. L. Fig. I Fig. 2

Charging Syphon,

allow the air to escape as the water descends. The funnel shown in Fig. 2 will he found useful in filling. On the outside of the pipe are soldered lengths J of \$\frac{1}{2}\$-in. brass wire to fit inside the syphon pipe, and the space thus formed will allow the air to escape. When the syphon is quite filled, the top of the pipe must be made perfectly air-tight; then, on turning the cock F, the water will commence to flow through D, continuing to do so as long as any water remains above the foot valve E, which has a strainer. The pipe forming the syphon should be perfectly air-tight, as otherwise the working of the syphon will be interfered with.

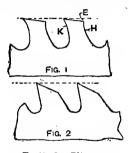
of the syphon will be interfered with.

Moulded Ornaments for Picture Frames.—Mould ornaments for picture frames may be made from a composition of whiting, water, glue, liuseed oil, and resin. The proportions of the different ingredients may vary, but the mixture should be soft and pliable, and should harden in a day or two if the ornament is large and heavy, or in a few hours if small and thin. The following proportions may serve as a guide, lpt. of water. 5 lb. of glue, lpt. of linseed oil, and 2 lb. of resin. Boni the whole together, and add sufficient whiting to render it of the required consistency. If more is made than is required immediately, it will require steaming to make it workable, as it soon begins to harden. The composition is pressed into moulds, which may be of wood, metal, or sulphur. The wooden moulds are carved or hollowed out of boxwood. For the other types of moulds, a model representing the object or ornament to be cast is made in clay or composition. This model is then surrounded with a wall of clay (or composition), given a coat of sweet oil, and the molten metal poured over it. When cold, the model is removed from the

mould and set in a wooden case. A piece of composition in a warm and soft state is then taken and pressed by hand into the mould. A wet board is placed over the surface of the mould, and screwed or weighted down; and this pressure, besides helping to force the composition into the mould, also makes it adhere to the wetted board, so that it may be readily pulled from the mould. When the cast is newly made, it is pliant and flexible, and may be fixed to curved or flat surfaces. When in this condition, hot water is sufficient to make it adhere, but if allowed to harden, it may be fixed to a frame with

Arranging Spokes in Cycle Wheels.—The arranging of spokes in a cycle wheel is so that the valvehole in the rim will be between two spokes running nearly parallel, thus giving more room for the hand when adjusting the valve or inflating the tyre. When the complete wheel is viewed from the side, the spokes should appear to be arranged in bunches of four, as it were. The outside spoke of these bunches will be seen to run nearly parallel with the outside spoke of the next bunch, thus leaving more space between these two spokes, and one of these spaces is the proper position for the valve hole. There has been observed in good shops a system of wheel building which seems very convenient. A few spokes are first inserted in both flanges of the hub; these pull almost opposite each other and tighten in the rim, the hub thus being made central and rigid. The wheel is then placed in the trueing stand and the remaining spokes are fitted. This way is preferable to first spoking one side of the wheel, as it is easier to handle the wheel while building it, besides being much speedier.

Teeth for Pit-saw.—The form of tooth in the saws employed by most pit-sawyers is shown in Fig. 1. The hollow H at the back, the high heel at E, and the hook at K, all tend to bring the dust on the top and so obscure the chalk line. A pit-saw properly worked and sharpened, with teeth to the shape of Fig. 2, should bring but very



Teeth for Pit-saw.

little dust to the top of the cut after the saw has cut into the timber to the extent of the width of the saw.

into the timber to the extent of the width of the saw.

Painting Window Frames to Resemble Stone.—

For the imitation of wrought freestone, one method is to prime the window frame with two coats of genuine white-lead tinted with yellow ochre mixed with 3 parts of holled oil and 1 part of turpentine, allowing each coat to dry thoroughly; apply over the lead paint two costs of stone-colour Duresco water paint: this should he dabbled on with a pound brush, and not laid off in the ordinary way. With a little experimenting the desired result may he easily obtained; but, if necessary, coarse sand or other material may be added. By adopting this method, the paint will be found to dry hard with a dull surface resembling stone, and also it will withstand atmospheric influences, influences

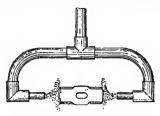
Influences,

Take-up Spring in Pfaff Sewing Machine.—The take-up spring in a Pfaff sewing machine regulates the amount of slack thread which the needle will throw out for the shuttle point to catch. This is also the use of the slack-thread pin. The reason why some machines are provided with the one, and some the other, is the difference in design, but, roughly speaking, where the take-up lever has a positive movement—that is to say, one which is driven by a link or cam, and which therefore cannot be varied—there is provided a spring to compensate for differences of cotton and material. As to the needle grooves, every needle is designed to give the best results in the machine it is intended for, and some have two long grooves, some one. The short groove ensures a loop being thrown out at the back. The amount of slack thread should be adjusted so as to ensure the cotton heing kept tight until the eye of the needle enters the work.

Staining and Polishing Chest of Drawers.—A chest of drawers constructed in red pine, if at all rough and with resin exuding around the knots, should be treated in the following way. With a sharp corner of a chisel scoop out a groove round the knots to remove the resin, and if the knots are loose, knock them partly out, touch round with glue, and knock them back again. For the rough places and round the knots mix best whiting into a stiff paste with very thin glue or patent size, adding a small quantity of dry brown umber to give it a walnut colour. Then with a putty or table knife spread it well over all rough and hollow places and set it aside to harden; then emooth down with No. 1 glasspaper held over a flat pad of cork or a smooth plece of wood. If the wood is to be stained walnut, mix equal parts of dry brown umber and vandyke brown in liquid ammonia to a thin paste-like paint, and add rainwater till the colour required is obtained, testing on odd plecess of similar wood. Apply with a brush, rubbing well in and finishing off in the direction of the grain with a piece of coarse rag. When dry, emooth down with No. 0 glasspaper, wipe over with raw linseed oil, apply polish to seal up the pores, and with a camel-hair rush add one or more coats of spirit varnish. When this is dry, rub down with worn glasspaper and apply more polish till a level, bright surface has been gained. Paste filler need not he used if this method is adopted.

Hardening Cast steel Hammers.—For hardening

Hardening Cast-steel Hammers.—For hardening small hammers the instructions given on p.41 may be followed, but for heavy hammers the point to be observed is to keep the centre of the hammer face as hard as the edges. The illustration shows the method of hardening a farrier's two-faced hammer. Water from the



· Hardening Cast steel Hammers.

main or cietern is led to the faces as illustrated. If a heavy hammer red hot is kept still in cold water for some seconds and taken out it will be found to be black at the edges of the face, but the centre of the face will be almost as red as when plunged into the water. It is therefore obvious that some method like that illustrated is necessary to cool the faces equally.

Burgundy Pitch Distemper.—Burgundy pitch, which is known also as pine resin and white pitch, is an impure resin obtained from the spruce fir-trees that grow in Norway and Sweden. Very little of the genuine pitch is placed on the market, an artificial pitch, prepared from melted resin 12 parts and linseed oil part, being chiefly used. It is principally employed in the preparation of plasters. Burgundy pitch may be used in washable distempers, but there are other materials that give better and cheaper results. Casein, gum arabic, glue, and glucose are the principal binding agents now used. A distemper containing Burgundy pitch may be made as follows. Procure 51b. of Pars, white, 71b. of slaked lime, 71b. of zinc white, 21b. of powdered glue size, \$1b. of Burgundy pitch, \$1b. of borax, and 1gal. of water. Dissolve the glue size, pitch, and borax in boiling water, then add the lime, finally stirring in the Paris white and zinc white, care being taken to avoid Inups. The above recipe makes a good white. Other colours may be prepared by omitting the Paris white and zinc white, and replacing them with a good quality dry colour. A little raw linseed oil added before using binds the preparation and renders it more washable.

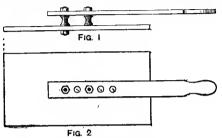
Toning Photographs on Albumenised Paper.—
The most suitable toning bath for commercial (not home-prepared) albumenised paper is (A) Borax 80 grs. dissolved in 10 oz. of hot water; (B) 2 grs. of gold dissolved in 10 oz. of hot water; (B) 2 grs. of gold dissolved in 10 oz. of water; mix A and B. The bath must not be used before it has cooled down to about 60° F. After thorough washing of the prints to rid them of any free silver nitrate, immerse the prints in the toning bath. The prints must be kept moving until the desired tone is reached; toning will take about fifteen minutes. As the desired tone is obtained on the prints, transfer them to a dish of water, and finally fix in hypo 3 oz. and water I pint. The ahove quantity of toning bath suffices for one whole sheet of paper or about four teen half-plates. For a smaller

number of prints a smaller quantity of toning solution should be made up, as the bath will not keep. The prints, before toning, should be immersed for a few minutes in a bath of sodium chloride (common salt) and then rinsed. The sodium chloride bath ensures the thorough removal of any silver nitrate that may be left on the prints. A teaspoonful of salt to a quart of water will suffice.

Printing Photographs in Sunlight,—Photographs should never be printed in the sunlight, except, perhaps, ferro-prussiate blue prints. The effect of printing in sunlight, and to a proportionably less degree in strong light, is to flatten the contrast and produce a red brown image which does not tone to such a pleasing colour, whilst in the case of vignettes their outlines would be rendered hard and decided.

would be rendered hard and decided.

Cycle Tube Bending Jig.—A bend to a radius of lin. inside ou a \$\frac{1}{2}\text{in.}\$ diameter tube is, of course, a very short bend, and it would be better to use a thicker gauge tube than is required, for any slight buckles could then be polished out. Make a beuding jig as shown in elevation and plan by Figs. I and 2. Plug one eud of the tube and fill it with lead, melt the lead, and warm the tube so that it is filled up closely. One end of the tube is fastened down to the plate, and the tube bent by means of the lever round the mandrel, which is slightly smaller than the inside diameter of the tube when hent. The mandrel and the wheel on the lever are grooved to take the tube to be bent. The mandrel could be fixed on a pin as shown and larger bends made by substituting a larger mandrel. The lever would then



Cycle Tube Bending Jlg.

have holes at suitable distances for the increased radii. It would probably be better for sharp bends to make complete circles as far as possible and cut the tube up to the required lengths. The tube is heated and the lead run out before cutting with a hacksaw.

Fixing Air Valve in Water Main.—All that is necessary in fixing an air valve in a water main is to drill and tap a hole in the highest part of the main where the air is likely to accumulate, the size of the hole suiting that of the valve to be fixed. For a 3-in. main a 3-in. valve would be large enough, and this would require a hole screwed for a 3-in. pipe. A stopcock should be fixed between the valve and the main, so that any necessary examination or repairs could be made without emptying the main. A cover box should be fixed over the valve to protect it from injury or from tampering, and the valve should also be protected from frost.

the valve should also be protected from frost.

Exposure in Enlarging Photographs.—The rule for finding the proportionate exposure in enlarging photographs is to add one to the ratio and square it. In most cases the best plan is to make a trial exposure, a plate being exposed in three sections. Having formed an idea of what the correct exposure should be, expose the centre portion of the plate for this time, and the other portions one for half and the other for double that time. To do this, draw out the shutter one-third of its length and give the supposed correct exposure; now draw out another third of the shutter and give half the first exposure; then draw out the rest of the shutter and give once again the second exposure. The portion of the plate that is the most nearly correct is taken as a guide, a further test exposure being made if necessary. Once found, the exposure and all necessary conditions of light, stop, plate, subject, and diameters are entered in the notebook.

Worm - holes in Violin.—The best way to kill the worms in the wood of a violin without damaging the instrument is to inject into the holes a solution of corrosive sublimate (hichloride of mercury) in spirit or in boiling water. Then fill them up with fine sawdust and thin glue. Be careful with the sublimate, as it is a very deadly poison. Perchloride of hydrogen is also recommended, and certainly is safer to handle than is the corrosive sublimate.

Casts of Carved Picture Frame.—For making a mould from which casts of a carved picture-frame corner can be taken, give the carving a thin coating of preparation made by dissolving a small quantity of stearin or wax candle in paraffin oil. Plaster-of-Paris may then be poured over the carving without fear of sticking; or, instead of plaster, equal parts of beeswax and resin may be used. For picture frames a composition of linseed oil, whiting, glue, and water may be made into a paste and pressed over the carving, which must be given a coat of sweet oil. Pull the pressing off while still soft and set aside till quite hard. This will serve as a mould from which any number of casts may be taken.

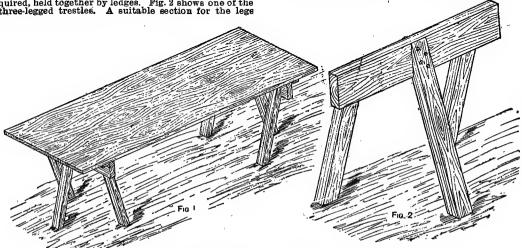
Removing Paraffin from Carpet.—To remove paraffin from a carpet place a quantity of blotting paper on the soaked part and run a warm iron over 1: continue this treatment until the paraffin is removed. For removing a stain left by the evaporation of paraffin wet well with petroleum spirit and treat with the blotting paper as above.

Portable Stand for Greengrocer.—Fig. 1 gives a general view of a portable stand for the outside of a greengrocer's shop on which to place haskets, etc. The top should be formed of two, three, or more boards, as required, held together by ledges. Fig. 2 shows one of the three-legged trestles. A suitable section for the legs

value"; the sum of the two represent the "saponification value". The acid value of beeswax is 20, the ester value 75, and the saponification value 95. As paraffin wax has no acid or ester value, a mixture of it with beeswax will lower both values in proportion to the amount of the former present, and the composition of the mixture is easily calculated. There is a rough way of determining the paraffin by heating the wax to 150°C. with strong sulphuric acid; this destroys the beeswax while not affecting the paraffin wax, which can be separated and purified; but as beeswax contains 13 per cent. of hydrocarbons, this process is not used.

carbons, this process is not used.

Finishing Silver Fretwork Articles. When finishing silver articles, if the fret cutting is completed, with a dead smooth file take off the burr or "fash" left by the fret saw. Next rough polish by means of a buffing lathe, which consists of a central headstock with right- and left-hand mandrils, and fitted with fast and lose pulleys in the centre. The mandrils extend from 12 in. to 18 in., according to the nature of the work to be done, and each mandril has a taper screw at the end on which to secure the polishing huffs. These may be of leather, linen, or a hard or soft brush, which again may be of bristle, soft brass, or even of hard steel as for scratch-brushing. The rough polishing is done with a



Portable Stand for Greengrocer.

would be 3 in. by 2 in., the horizontal piece being 5 in. by 2 in. The legs should be cut to fit as shown, and the most satisfactory way of securing them to the top is by stent screws

Repainting Bassinette.—The ironwork, springs, wheels, etc., of a bassinette are usually painted with enamel, which may be procured from most ironmongers. The hody and general woodwork are painted and then varnished. The paints used are specially ground to a stiff paste in turpentine, afterwards thinned down with 4 parts of turpentine and 1 part of gold-size. The paints are applied in the usual manner, allowed to dry, and rubbed down lightly with No. 0 sandpaper, dusted, and then given a coat of hard copal varnish.

Analysing Mixture of Waxes.—In the analysis of a mixture of beeswax and paraffin wax it is not usual, nor is it necessary, to separate them. Beeswax consists principally of cerotic acid and myricyl palmitate; the former will combine with alkali readily, while the latter can be saponliked if heated with an alkali. Paraffin is a hydrocarbon, and will not combine with an alkali under any condition. The analysis of a wax by Huhl's process is as follows:—2½ grams of the wax are carefully weighed out, dissolved in hot alcohol (neutral). to which a few drops of phenol-phthalein have been added, and ½ normal caustic potash solution is dropped in until the liquid is faintly pink; this represents the amount of alkali required to neutralise the free cerotic acid. 25 c.c. of the ½ normal alkali are now added, and the flask is heated for forty minutes under an inverted condenser, after which the excess of alkali is determined by titration with ½ normal hydrochloric acid; the amount used is that required to saponify the myricyl palmitate. The determinations are calculated into the number of milk-grams of caustic potash required for lgram of wax, and the cerotic acid determination, called the "acid value," the myricyl palmitate determination being called the "ester

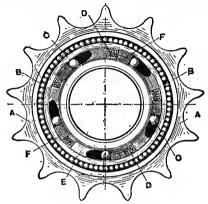
circular buff, say 3 in. in diameter for small work. The leather, called "bull neck," is cut as round as possible, a small hole punched in the centre and screwed on the taper screw of the mandril, and the disc is turned up true with an old sharp knife, an upright piece of wood being used as a hand-rest. This is fed with prepared Trent sand and common oil, the article being held underneath the revolving buff and worked backwards and forwards till the scratches are removed. If the sliver is very thin it is usually placed on a small flat piece of wood to prevent its heing bent. At this stage the work is sent to be engraved or otherwise ornamented. The work should then be boiled in a strong solution of potash, 11b. of potash to 2 gal. of water, to remove greas and dirt. The leather buff and Trent sand is then put aside in a cloth to be used over and over again. A linen delly about 6 in. in diameter is screwed on the mandril nose, and rouge and water made into a thin paste is applied with the finger to the piece to be polished, which is then put in contact with the revolving delly. This is repeated till a high condition of polish is attained. The final polish by power is arrived at with a lead lap fed with still finer rouge paste, and otherwise by "handing up." This consists in the work being polished by friction, using the ball of the thumb with fine rouge paste. Next the article is washed out in het water, dried in hot bexweed sawdust, and polished with a clean chamois leather and then carded. Another system is lightly to electroplate the silver goods, and then handburnish the various parts in order to produce an effect of light and shade in the general appearance.

Cementing Bass Brooms.—Brushmakers' pitch is the best material to use for securing bass in brooms. This material is kept melted over a slow fire, and applied like glue to the holes in the broom heads, the hundles of bass or bristles being forced in while the pitch is still hot.

Pipe Tongs.—When forging pipe tongs, make the jaw that grips the pipe, and work from that when making the jaw that clips the pipe. For small tongs, say from \(\frac{1}{2} \) in., it is a good plan to forge the grip jaw out of solid steel, as the part that grips the pipe is so small that there is some difficulty in facing them with steel. When using iron, roughly forge the jaw nearly to size and then get a piece of double shear steel of the width of the part that grips the pipe and about \(\frac{1}{2} \) in. thick; take a welding heat on the steel and the top part of the jaw, put the steel along the edge of the anvil nearest the worker, place the iron on it, and smartly weld together with the hand hammer. Cut off the steel that hangs over the edges of the iron, square it up, take a second welding heat on it, and clean up and fluish to the desired size. Then forge the other jaw and fit the two to the size required. two to the size required.

two to the size required.

Fitting Free Wheel to Safety Bleycle.—With one or two exceptions, free wheels can be fitted to the hub in place of the fixed wheel without any alterations. In these exceptions the clutch is part of the hub, and must be used to build the back wheel. The free wheel is made mainly on two principles, the roller friction, and the pawl or ratchet. To fit a free wheel, the old chain ring must be removed, and the diameter of the hub barrel and the number of threads to the inch ascertained, so that the free wheel may be bought with the same thread, etc. To remove the old chain ring, the lock ring, which has a left-hand thread, and



Free Wheel Clutch.

Pree Wheel Clutch.

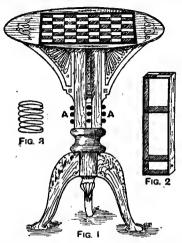
nnscrews to the right, must be taken off. Pin-holes are provided in the top of the lock nut; a pin spanner should be made to fit these holes, or the nut may be knocked round with a small punch. The chain ring can be removed with a punch or a chain-ring wrench. All that it is necessary to do is to remove the chain, take out the back wheel, remove the lock nut and chain wheel, screw the free wheel on the hub as far as possible, replace the wheel and chain, and turn the crank round nntil the free wheel is locked tight against the shoulder of the hub barrel. The accompanying sketch illustrates a roller friction clutch with the front plate removed. A is the chain ring; B, ½-in. balls: C, rollers; D, springs; E, clutch. It will be seen that the clutch is screwed on the hub barrel, and always revolves with it. When the chain ring is pulled round in one direction, the five rollers are drawn by friction against the ring up the five inclined planes, and are jammed between the clutch and ring, and the road wheel revolves with it. When the chain ring is held still, as is the case in free-wheeling, the clutch revolves with the road wheel, causing the rollers to run back into the bottom of the inclined planes, where they are kept by friction against the hub ring until pedaling commences again. The blocks F at the back of the rollers are to keep them aguare, and the small spiral springs keep the blocks up to their work. The ½-in. balls take up any side-play. In the ratchet clutch, the chain ring has a ratchet running round its circumference. In recesses in the clutch pawls are fitted, which engage with the ratchet while driving. When free-wheeling, the pawls run over the ratchet, as in an engineer's ratchet brace. In some cases rocking pawls are used, but in most cases the pawls are kept up to their work by a flat or small coil spring. It is necessary to lubricate a free wheel frequently, and occasionally swilling out with benzoline or parafin will prevent the springs and rollers sticking with dirt, which

The brake is generally applied by a rising cam, which forces the brake block into the drum.

Cleaning Oily Floor.—To clean a wood floor that is saturated with oil, wash and sorub the floor with benzollne; mix l b. of quicklime and l b. of soda in a bucketful of hot water, and with this well scour the floor. A little Calais sand may also be used with advantage. By adopting this method the oil can be easily removed, providing it is on the surface and has not penetrated through the wood.

through the wood.

Chees Table with Secret Spring Drawer.—Fig. 1 illustrates a chess or draughts table with secret spring drawer, which can easily he made; only the construction of the trunk requires a few words of explanation. This trunk has a deep hole into which the secret square drawer, of about 3-in. side, is dropped; the four middle squares of the chess board form the top exactly (see Fig. 2), and must fit into place accurately to hide the presence of the drawer. It will be noticed that the drawer should he shorter than the portion of the body into which it fits by 2 in. This is for the spring, which consists of a few turns of an ordinary upholeterer's chair spring, standing 3 in. high (as in Fig. 3), and which can be dropped into its place without any fastening. The two middle knobs A (Fig. 1) on each side of the trunk have pins on them which go through the



Chess Table with Secret Spring Drawer.

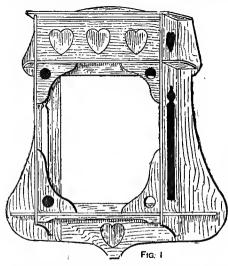
body into the holes (see Fig. 2) at the hottom of the secret drawer and so hold it in its place. The two middle knobs have only to be pulled out to make the drawer rise I in. above the table top, when it can be lifted out, and as the twelve knobs must be exactly alike, it will not be an easy matter for the uninitiated to guess the secret fastening.

Welding Cast Steel Picks.—Some so-called cast steel picks are made of unweldable metal. The only thing to be done with this kind of tool is to keep drawing it down until worn out and then consign it to the scrap heap. However, if the picks are made of a steel that will weld, the hest way to line them up is to thicken the end well by jumping up, then split it open with a hot chisel and form a V scarf. Forge the end of the piece of iron to correspond. For the welding heat, get the iron to a white heat and the steel to a yellow slimy heat. For a flux, use clean white sand for the iron, and for the steel use a composition made up from 2 oz. each of common chalk, common sods, and burnt borax, and 1 b. of silver sand well mixed together. Well roll the steel in this mixture several times whilst getting the welding heat. the welding heat.

Painting Aquarium.—A suitable paint for the inside of a fish aquarium may be made by mixing together 3 parts of good copal varnish and 1 part of gold size; use this varnish as a medium for mixing with zinc white. Any good paste paint may be used for tinting the white. Aspinall's bath enamel is also suitable for the purpose the purpose.

Setting Chronometer in Beat.—A chronometer is in beat if the impulse pallet in the large roller points exactly to the scape-wheel pivots when the balance is at rest. It is set in beat by turning the hairspring collet round as required.

Wooden Wall Brackets.—Figa. 1 and 2 illustrate two easily made brackets, for which common white wood \$int. thick, finished to about \$in., may be used. The brackets may be stained green and given one or two coats of sheliac, but a thick varnish should not be used, as the appearance is better with little or no polish. The bracket illustrated by Fig. 1 is 9\$in. by 12in. in the main opening, and 5 io. deep; the other proportions can be obtained from the sketch. Commence by cutting out the two curved piecea which form the back. This can be done with bow saw, gouge, and spokeshave, or with the fret saw. Then cut out the two sides. The larger holes should be removed by the fret or bow saw and finished off. Erect these sidea in position on the back pieces about 1 in. from the atraight edge and nail them on. Cut out the four small side brackets, rounding them in front. Put a little glue on the edges and then nail them in position, both to the side and back; the two wings which unite the back and sides will then be complete, and the three shelves will join them together. Cut out four pieces of wood, each 3\$in long and \$in. square; glue these in the corners, behind the little curved pieces with the round holes in them, in such a manner that the shelves are fixed in place. Next cut out pieces to form the top and bottom part of the back. The lower piece has a heart cut through it, and the upper one a curved top. Make these fit exactly between the sides, projecting lin. into the opening, and nail them to the back

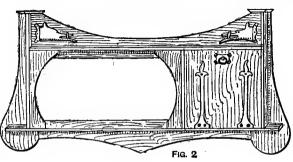


edge of the shelf. Now cut out the front top with three hearts, and glue it in place. Along its upper edge glue a strip of wood 1½ in. wide, projecting forwards ½ in., and having the ends bevelled to match two tapering pieces fastened on the top edges of the sides. Flower pots with ferns in them may stand in the well behind the hearts, and it only remains toglue the four corner pieces in place. The back looks well if filled in with pleated china silk. The horizontal bracket (Fig. 2) measures 2½ in. between the sides, the height between the shelves being 8 in., and the depth 4 in. From two pieces 6 in. wide and about 144 in. long the two curved portions of the back are cut. On these the ends are nailed in position. The bottom shelf, the ends of which are curved, is nailed to the sides and back pieces, and then the upper shelf is fitted and nailed to the sides. Finally the partition for the cupboard is fitted and nailed. The decorated curved piece is fixed in. from the front edge, and the central lower part of the back fits between the aide wings and is nailed to the back edge of the bottom shelf; it projects lin upwards, a plain clip, 2½ in. wide, projecting lin. downwards, helng nailed to the back of the upper shelf. The curved pieces for the opening are glued in, and the door is cut from a single piece, and has two light battens screwed across it inside to prevent warping; it is fastened at the bottom with two light hinges, and two long sham hinges are cut out of thin copper, well ong sham hinges are cut out of thin copper, well polished, and pinned to it when the whole has heen stained and varnished. To make the two hoar's heads, cut a piece of 1-in. soft wood 5 in. long by 3in. wide, and plane the top smooth. Flatten a piece of soft copper rather more than \$\frac{1}{2}\$ in. thick and 6 in. long by 4 in. wide by putting a piece of smooth wood on it and striking with a hammer. Cut off a triangular piece from each corner and place the copper on the prepared wood and turn down the edges, driving some tintacks th

copper into the wood. Draw the outline of the head with a soft pencil or ink, making it a little bigger all round than the finished size. Then run a fairly broad blunt bradawl round the linea, tapping it continuously with a hammer or mallet, and thus indenting a continuous line in the copper. Now cut the point off a long French nail, making it quite square so as to form a blunt punch. With this go all round the outline, just touching the latter, and hitting a fairly hard blow with the hammer. The copper under the punch is thus driven down into the wood, the remainder all round rising. Then with this bradawl once more trace the outline, but hit hard enough to cut through the copper. Finish the rough edges with a smooth file and polish the front with fine emery or sandpaper. The eye may be drilled or punched, and four holes for pine should also be made. Two small brackets, not illustrated, are glued so as to hide the heads of the nails fastening the upper shelf, and two top shelyes with bevelled edges are secured to the sides. The back may be left open, or filled with glass or allk. The sham hinges are cut out of thin copper with a strong pair of scissors, and a little repoussé work put into them improves the effect.

Repainting Butcher's Cart.—To repaint a butcher's

Repainting Butcher's Cart.—To repaint a butcher's cart dark green, with light green picking out lines, give new work three coats of light colour made from the whitelead and a little driers, thinning down with raw lioseed oil and turpentine, and adding a little vegetable black or lampblack to give tone. When this is dry, a coat of dark lead colour is given, after which two coats of dark green paint are put on, the first coat being made to dry in about ten hours, while the second coat should have a little carriage varnish added to it to make a good job.



Wooden Wall Brackets.

A third coat, with varnish added, would give a good surface, and should stand for two days to harden. It is then flatted down with pumice powder and cloth, using plenty of water. Then the lining out is done, after which the body and other parts are sponged to remove any pumice dust that may have been left on, using a No. 6 water tool to get all dust out of the corners. When the wood has been dried off with a chamois leather, apply a coat of hard-drying carriage varnish, which should stand for one day to harden off, and is then flatted down as for the last coat of green, a coat of finishing carriage varnish being added. If the weather is damp or muddy, the cart should not be used for two weeks, or mud will make white spots in the varnish; in bright weather it may be used in a week from when it was finished.

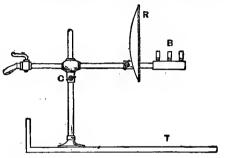
Painting Wood Flesh Colour.—In painting new wood flesh colour good results may be obtained by first spplying a paint composed of 7th. of white-lead, † lb. of patent driers, † pt. of beiled oil, † pt. of turpentine, and lb. of venetian red. Mix well together to a uniform consistency, strain, and brush well into the wood until all suction is stopped, finishing by laying off lightly. Allow the paint to dry hard, rub over lightly with No. 0 sandpaper until the surface of the wood is perfectly smooth, then apply a coat of paint made by mixing together 61b. of zinc white, 20z. of yellow ochre, and 10z. of venetian red, all paste paints ground in oil. Thin down to the required consistency with † pt. of boiled oil, † pt. of copal varnish, † lb. of patent driers, and † pt. of turpentine; apply thinly and evenly. This preparation dries hard with a good gloss in a few hours. For a very brilliant finish, omit the copal varnish and raplace with boiled oil. Allow it to dry hard, and apply a finishing coat of hard copal varnish.

Removing Leather from Brass.—Boiling in a strong solution of caustic soda will destroy the leather so that it can easily be stripped from the brass without appreciably affecting the latter.

Light Yellow Stopping for Stone.—For stopping some of the Derby grits, such as Darley Dale, etc., shellae stopping as used for the collicit stones is of no use. The following, however, is useful. Mix resin and beeswax in about equal parts over a fire, or preferably over a hot plate, in a pipkin, until the resin and beeswax are melted and well incorporated; add sufficient dust of the pounded stone to produce a stift paste, which, when thoroughly kneaded, should be poured into water and made up into sticks, and the cement is then ready for use. To unite broken pieces of stone or to fill up a cavity, warm the affected portions of stone by means of hot irons until the stones are just hot enough to melt the cement; apply the cement to the fracture and smooth off with the iron. This cement has no lasting properties when exposed to the weather, but will serve for internal work. If the piece of broken stone is not too large, use Portland cement mixed with some of the pounded stone-dust, and a little mineral oxide to produce the necessary colour. This will make a far more satisfactory and lasting job than the resin-beeswax cement described above.

Acetylene Bnrner for Optical Lantern.—The

Acetylene Bnrner for Optical Lantern.—The accompanying illustration shows an optical lantern fitting for hurning acetylene. The only part needing description is the arrangement of burners. Those generally used are Bray's No. 000 (acetylene), and the light given is about equal to 200 candle power. The burners may be placed in a row as shown, or may be arranged so that all three burners will face the lens, one above two like a triangle. The illumination obtained



Acetylene Burner for Optical Lantern,

by this means is not sufficient for cinematograph films if large pictures are to be shown, but would be suitable for small pictures, say 10 ft. in diameter, perhaps a little larger. In the illustration, B shows the burners, R reflector, P the supporting pin, C the clamping screw, N the gas nozzle, and T the tray.

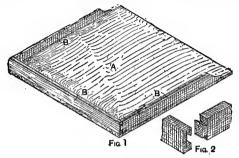
Painting and Varnishing Street Door.—To get a satisfactory finish on a badly blistered door, the paint should be removed. Therefore, with a painter's blow-lamp fuse the paint, and scrape it off immediately with a knife or scraper. The door should then be thoroughly rubbed down with No. 1s sandpaper to free it from inequalities, dusted well, and the knots painted over with patent knotting. Then apply a coat of priming paint made from 3 lb. of genuine white-lead and 1lb. of red-lead, thinned down with equal parts of boiled oil and turpentine. The second or ground coat may be a dark grey or green mixed with boiled oil 3 parts, turps 2 parts, and when dry should be rubbed down with No. I sandpaper and dusted as before. Another coat may be given if necessary. The finishing coat should now be applied, which, for bronze green, should be made and mixed as follows. Bronze green paste paint 31 lb., patent driers ½ lb., with boiled oil 3 parts, and turps I part. Then rub down lightly with No. 0 sandpaper as before, dust well, and apply two coats of hard outside copal varnish. If it is not desired to remove the old paint, remove the blisters and rub or flat down with pumice-stone, then apply two coats of green as above, and finally apply two coats of hard outside copal varnish, which will produce a bright glossy appearance.

Cutting Book Edges.—A bookbinder's cutting press

Cutting Book Edges.—A bookbinder's cutting press without guide bars has its disadvantages, but it need not prevent the back of the book remaining level while being cut. It is quite usual, after having made the book perfectly flat, to pass a cord round it and draw the cord tight. The book then keeps flat and does not shift while being screwed up in the press. The usual procedure for cutting a book is as follows. The book when sewn and with the end-papers put on, is glued up, that is the back is glued and allowed to become dry. The book is then placed on the bench and looked over for the shortest leaf. Its measurements

being taken with a pair of compasses, the book is closed, and two marks are made on the end-paper with the compasses, measuring from the back. A piece of cord with a slip-knot on it is passed round the ends of the hook near the back and is drawn nearly tight. Then the book is taken between the hands and knocked up, the back heing beaten on the press or any level surface. When the book is perfectly flat the cord is drawn tighter and made fast. Two cutting boards are now brought forward, the book is put on one of them, and the other is placed against the marks made with the compasses. The second board must have a perfectly straight edge, and is really the cutting edge. Next the book is lifted with the hoards in the left hand, and carefully lowered into the press, which meantime is screwed up with the right hand. When the press is tight enough to hold the book, stop screwing and adjust the guide board carefully until it is quite level with the cheek of the press. To ensure the book and boards moving together, the guide board may first be slightly wetted by the tongue. The press is now screwed up tightly and the cutting doue. When the fore-edge is cut, the back of the book is rounded and the ends are cut, but it will not now be necessary to tie up the book, as with ordinary precoution it will keep in a good shape.

Bakeboard.—A bakeboard is a very handy kitchen utensil that can be made in white-wood at little cost. Cut the bottom A (Fig. 1) of ½-in. or ½-in. wood 24½ in. square. If wood of this breadth cannot be had, two pieces should be neatly joined. The back and sides B should be ¼ in. thick by 2 in. broad, the former being 2½ in. long, while the



Bakeboard.

latter measures 22½ in. Square the ends of the back and sides which have to be dovetsiled, and shape the other ends of the sides as illustrated. Cut the dovetsils in the sides and back as shown in Fig. 2 and glue them together. Then plane the bottom smooth and round the corners at the front. When the frame is quite dry, plans the edges flush, and glue the bottom edges, fastening the frame to the bottom by 1-in. screw nails. Plane the projecting edges of the bottom flush with the frame, and round over or run a sash or ogee moulding on the top edge.

Filling for Cracks in White Enamel Leather.—A good filling for cracks in white enamel leather can be made by boiling well together is be of sugar, loz. of gum, and llb. of white-lead. Melt the sugar and gum first.

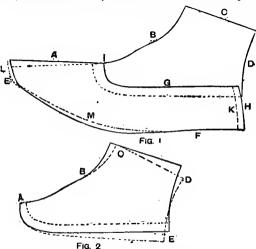
Coloured Washes for Brickwork.—Washes for brickwork are given helow. Dissolve 11b. of powdered gum arabic and 21b. of concentrated size in sufficient warm water to make a mucilage, then add 80z. of powdered borax and stir all well together; the mixture should now be diluted with about 2 gal. of hot water, and the desired colouring, such as lampblack, yellow ochne, umber; and venetian red, added. This preparation, which, when dry, forms an excellent wash that is insoluble in water, should be well rubbed into the brickwork with a heavy distemper or pound brush. Another simple method is to mix together 2 parts superfine Portland cement, 1 part slaked lime, and 1 part lampblack, made into a wash, using stale ale as a hinding agent. Apply as above. A very adhesive black stopping may be prepared by mixing together sharp sand 10 parts, lime 3 parts, litharge 2 parts, lampblack 2 parts; mix into a paste with boiled oil sufficient for immediate use, as the preparation rapidly hardens. Rub down the brickwork with linseed oil before using the stopping, which may be applied as ordinary mortar.

Cement for Uniting Indiarubber and Vulcanite.—

Cement for Uniting Indiarubber and Vulcanite.— Ordinary rubber solution, sold by dealers in cyclist materials, is suitable for uniting rubber and vulcanite. As vulcanite usually has a hard and somewhat smooth surface, the cement would adhere better if the vulcanite were slightly roughened by fine glasspaper. Priming Paint for Woodwork.—The following is a recipe for a priming paint for new woodwork. Bemove all roughness from the wood by rubbing down with No. 1 sandpaper, dust well, and apply a coat of patent knotting thinly and evenly over all the knots. A coat of priming paint made by mixing together 14 b. of white-lead and 11b. of patent driers, thinned down to the required consistency with equal parts of raw linseed oil and turpentine, should next be given. When priming hard woods as oak, pine, birch, etc., omit the driers and replace with 21b. of red-lead. The ground coats may then be applied and prepared according to the finish required. The most economical and durable results are obtained by using the genuine or pure white-lead, the adulterated material producing inferior work.

Cutting Patterns for Right and Left Boots.—Some Priming Paint for Woodwork.—The following is

cutting Patterns for Right and Left Boots.—Some of the principles of pattern-cutting for right and left hoots are explained below. The last which is used is supposed to be thick at the instep on the inside, the instep projecting over the waist, causing the back seam of the golosh to lean inside and the lacing at the front top of the vamp to appear to run to the outside at the toe instead of to the centre of the toe. The last described is of the type known as straight-inside, hence the upper running towards the outside, this being much longer from the centre of the heel to the tip of the toe than from like points on the inside. For such work it is best to cut the pattern of the golosh as described below, but in this case the projection will have to be allowed for, therefore it will be necessary to



Cutting Patterns for Right and Left Boots.

Cutting Patterns for Right and Left Boots.

cut the quarter patterns for inside and outside. After cutting the ground pattern to the last and ankle and heel measures (see plain lines A. B. C. D. E. and F. Fig. 1), cut the golosh in the usual way as A. E. F. G. and H. but in. longer and a little larger at E. as shown by the dotted line, but first marking the proper helght of the vamp on the ground pattern at I. Try the golosh pattern on the last, and tack the centre of the vamp I on the centre of the front of the last. Draw the pattern round the outside at the back, bring the inside portion round, and mark it off from the centre of the back at an equal distance to the outside; see dotted line K. Then ignore the proper centre line at the toe, with the exception that \(\frac{3}{2}\) in is to be taken off the inside back. Make the centre of the toe \(\frac{3}{2}\) in. from the proper centre to the outside of the toe as L, and fold it up to the centre I, as dotted in LI. Now place the golosh pattern back again, getting the point right at I, but letting it be underneath this time, and seeing that this new centre line is exact with the line AI, and trim off the toe to the top pattern at LE. Then from the bottom of the inside take off about \(\frac{3}{2}\) in. to the dotted line M (this is done to save leather in cutting). The quarter pattern is somewhat harder to explain, but is done similarly to ordinary pattern cutting, for although the front curves are different, thus throwing the top line and back out of gear, one curve must be equal to the other. Thus when the quarter pattern as just drafted (Fig. 1) has been cut, and produced by the pattern formed by the full lines in Fig. 2, place this on another piece of paper, and cut true from A to B; press the little finger very tightly on A, and the forefinger on B, and with the right hand draw the top point back to C. Hold the two there with the left thumb, only letting the little finger loose, and cut

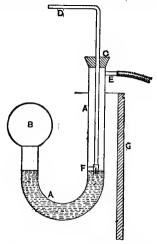
to the dotted lines BC, CD, and DE, being careful to nots this last point. Then put \underline{A} in place again and cut the bottom to \underline{A} E as shown by the dotted line and the back line DE, true to the first pattern.

line D E, true to the first pattern.

Using Gilder's Tip.—A gilder's tip is drawn lightly over the hair of the head or down the cheek, of which the natural oil is transferred to the tip, and causesit to lift the gold. But if the gold has been spread on a cushion, this must be perfectly clean and dry, and should be cleaned now and again by rubbing over with bath-brick or brick-dust. Then the dust is cleared off the cushion with the gold knife. The leather of the gold cushion should never be touched with the hands or brushed over with an ordinary brush. dinary brush.

dinary brush.

Thermostat for Hot-air Incubator.—There is much greater difficulty in regulating the temperature of a hot-air incubator than that of a water-heated one, as it is more easily affected by fluctuations in the atmospheric temperature, and that is why an ether thermostat is too sensitive. An air thermostat (see accompanying illustration) will be found to be less sensitive. This consists of a U-shaped tube A with a bulb B on one limb and a cork C fixed in the other, with an entry tube D for the gas, and an exit tube E on the U. The entry tube has a minute hole in one side to keep a trace of gas always passing so that the fiame never goes out; at the bottom is cemented the slit tube of a mapping pen F from which the nih has been broken. Mercury is placed in the U tube, and the gas entry tube



Thermostat for Hot-air incubator.

is drawn out or pushed in until the required temperature is obtained. G shows a section of the corner of the incubator

Setting Gem Rings.—In setting one diamond and four pearls in a finger ring, first drill the hole through for the diamond a little smaller in diameter than the stone. A hearing or seating for the stone to rest on is next cut by means of a medium size half-round scorper, taking care that the stone only goes comfortably in without shake. The holes for the pearls are next drilled just deep enough for the edges of the pearls to come a little below the edges of the holes; these holes are made with a flatbladed drill or pearl drill. Having fitted all the stones, cut the side grooves, leaving small pieces of gold between the stones and one piece at each end. Place all the stones in position, and with the point of a strong spit sticker push over the edges of the stones the little pressure, working them on the top of each with a little pressure, working them into shape. The side grooves are then brightened by cutting them over again with a spit sticker, the back of which has been polished to give a smooth cut.

Cream for Black Leather Bnots.—Below is a good

Cream for Black Leather Buots.—Below is a good cream for black leathers. Mix 11b. of curd soap, 21b. of beeswax, 21b. of oil of turpeutine, and 41b. of water, with black or any other colouring matter to the shade required. The soap should be cut up and dissolved in water hy boiling separately. The wax should be dissolved in the turps by heating the two together. Pour in the soap solution and briskly stir until the whole is of a creamy nature and cool. Aniline colours should be mixed with the water before the soap is added.

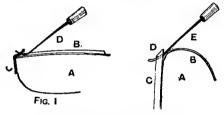
Table Jelly.—For making table jellies gelatine should be dissolved in about five times its weight of water by a genthe heat, theu about half its weight of augar, a trace of colouring matter, and essence should be added; the jelly is the left till next day to set. It may be granulated by forcing it through a coarse sieve in a similar manner to mashing potatoes.

manner to masning potatoes.

Enamelled Kettle Leaking.—For stopping a leak round the spout of an enamelled kettle, first scrape the metal quite clean and bright at the leaky part, and then apply some raw spirit. Rinse this off, and if the metal appears clean and bright, apply some killed spirits, and solder the part in the usual way. If the metal is not clean after rinsing the raw spirit off, continue applying the acid until the metallic aurface is sufficiently clean for soldering purposes.

ciently clean for soldering purposes.

Ladies' Shoes with Pointed Toes.—In getting the sole and the upper quite close so that the sewing is completely hidden all round when making a pair of very pointed shoes with thin bevel soles, much depends on the fitting of the inner sole, which should not he feathered too narrow, or, when stitching the sole on, the stitches will be thrown just under the edge of the feather of the inner sole. The holing of the inner sole should be done so that the awl will come out just in the extreme recess that the feathering has made, and in sewing in the welt the sewing awl should not be too straight, but should be curved, so that when it is pushed through the upper after lasting the stitches will fall as near above this point as possible (see Fig. 1, in which A is the last, B the inner sole, C the upper, and D the sewing awl). After the sole has been rounded up and the piece bevelled off round the edge, the channel, as will be seen, will be somewhat farther in than for



Ladies' Shees with Pointed Toes.

ordinary work. Thus it is obvious that the stitching awl will need to be straighter than usual to make the work easier (see Fig. 2, in which A is the last, B the upper, C the sole, D the bevel, and E the awl). Both Figs. l and 2 are transverse sections of the shoe. One other thing that will be helpful is as follows:—Just where the stitches would lie on the welt in stitching, with the point of a sewing awl scratch a very shallow channel in the welt. Then when the shoe is stitched, the channel pasted and set down, and the stitches are well rubbed down with paste or gum, the whole of the bottom can be well and evenly hammered down, and then the edge tapped down all round with the hammer to get it as close as desired.

all round with the hammer to get it as close as desired.

Finding Time by 4-ft. Rod.—There may be some rough and ready way of finding time by means of a rod, but the following method is possible, though tedious. Stand the rod vertical and measure the length of its shadow. By taking the shadow length as radius and the rod as a tangent, the value of the angle of elevation of the sun can be calculated by the aid of a table of natural tangents. Thus in a rough and approximate manner the 4-ft. rod takes the place of a sextant as used in navigation, and by the same method that the sailor uses, the time can be calculated with the aid of a table of logarithms and an almanac.

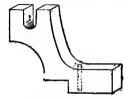
Prize Medals.—White metal of which prize medals are made is cast in ingote, rolled out by machinery into sheets, then slit into narrow atrips of the requisite width; these strips are highly pollahed, then cut by circular cutters into dises of the required size. These discs or blanks are then placed one by one on a steel anvil engraved with the design for one side of the medal, and a steel die with the design for the other side is brought sharply down on the blank by means of powerful machinery, thus making a clear, sharp impression on both faces at once. This method of making medals surpasses that of casting them in moulds. Unless the moulds are made of iron, engraved or sunk as a steel die is prepared, the production would be very rough, and the cost would not be less than the price at which the finlahed medals can be procured. A rough imitation of a medal may be made with a casting of the white metal in a plaster-of-Paris mould well saturated with linseed oil and baked enough to carbonise the oil

in the peres of the mould. Or a better mould for the purpose can be made of Parian cement as directed in Series II., p. 350. No special instructions are necessary for gilding or silvering these medals. They are to be treated as pewter or Britannia metal, and electroglided or electro-silvered as may be required.

glided or electro-silvered as may be required.

Ciarionet Reeds.—For the high notes of a clarionet a hard reed is chosen, but for a song accompaniment, especially if in the lower register, a soft reed is to be preferred. But the curve of the monthpiece and the strength of the player's lips are of equal importance in determining the choice of reed. A hard reed requires a closer "lay," or, in other words, a flatter curve and smaller space between the reed and the monthpiece. If a hard reed is used on a mouthpiece suitable for a soft reed, the player's lips must bring the reed closer to the mouthpiece or else more wind will be required to play the instrument. If a closely laid mouthpiece is used for a soft reed, the pressure of the lips for the highest notes will probably close the aperture entirely. So it will be seen that not only must the compass and character of the music be studied, but the lay of the mouthpiece and the player's lips and lung power should have a determining influence. A better tone is obtained by a hard reed if all the other surroundings are favourable; therefore have the mouthpiece laid rather close, and choose the hardest reed that can be played easily. It is of great importance that the curves of the mouthpiece should be alike on each edge of the aperture.

Appliance for Smocking.—Doubtless there will be considerable difficulty in constructing a gathering machine for use on a sewing machine in smocking fancy work. But thin material can be gathered on



Appliance for Smocking.

an ordinary sewing machine by the use of a special foot shaped like the accompanying illustration.

Bottles Made from Bladders.—Bladders from which bottles are to be made should be thoroughly cleansed, both inside and out, with clean warm water and dried very slowly, rubbing in, from time to time, a small quantity of olive or castor oil to counteract the tendency to become hard. The necks, of 'tinplate or brass, should have two depressions or grooves, and on these the bladders are wired. Bladders may be suitable for spirits, but should not be used for water or solutions of any kind containing water. The membrane, being a highly nitrogenous substance, is rapidly acted upon by bacteria, which cause it to putrefy; and any liquid (except spirit, which is preservative) kept in the bladder would in a short time become so tainted as to be undrinkable.

Bending Split Tube.—To bend split tube, securely solder a strip of strong sheet metal in the open cut in the tube and along on each side, and then bend the tube round on a template of the desired shape. Tube that is 1 in. or more in diameter will probably have to be loaded with lead, or a composition of equal parts of resin and pitch, and then bent by any of the usual methods; after getting the tube to shape, unload it again.

again.

Needle Cotton Breaking in Pfaff Sewing Machine.

The cause of the needle cotton of a Pfaff sewing machine breaking at a seam may be that the needle is too small, or the material too hard. Try a larger needle, and soap the seams on the wrong side before sewing. The discs are connected by a stud which passes through the face-plate and engages with a long flat spring, which in turn is tightened by the tension screw in the top of the face-plate. To remove the face-plate, it is only necessary to take out the two screws that pass through the front. The operation of releasing the tension can be seen clearly when the face-plate is removed. A small releaser connected with the presser bar pushes out the stud and discs.

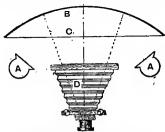
Cozeh Painters' Janan Putty.—Janan putty is made

Coach Painters' Japan Putty.—Japan putty is made by mixing together equal parts of dry white-lead and whitling, and making into a paste free from lumps with gold-size. Covered Wires of Grand Piane Breaking.—If, when attempting to replace broken covered wires in a grand piano, they snap during the process of tuning, probably it will be found that there is excessive side or downward strain bearing on a sharp arris edge of the tension stud situated at a point to form the top bridge. The stud through which the troublesome wire must pass should be removed to enable the stud to be slightly countersunk on both sides; a trace of dry blacklead in the hole and ou the bottom bridge will also be an improvement. When tightening up the wire for tuning, before attempting to pull it up to the correct pitch, notice whether the ten in extends the whole length of the wire. Careful observation will reveal that the string is not perfectly parallel, but dips downwards at each end—the tail end to fasten on the hitch pin, and the coll end to encircle the tuning peg. At the latter point it is expedient that the wire should not be twisted in its length or that one coil shall overlap the other.

Marking Glass.—For marking on glass use something

Marking Glass.—For marking on glass use something softer than chalk. Pipeclay is often used, but soap is better; this can be easily cut into a convenient form for holding, does not scratch the glass, and can be readily cleaned off when no longer needed.

Enlarging Negatives without Condenser.—The best plan of enlarging is that shown in the accompanying illustration, where two lamps A are used to secure even illumination, and these lamps shine upon a sheet



Enlarging Photographic Negatives without a Condenser.

of cardboard B bent into circular form and held so by a thread C. D is the camera. The cardboard acts as a reflector. The exposure is of course considerably longer than when a condenser is used, but if the lens works at 1/6 it will not be very prolonged.

works at 1/6 it will not be very prolonged.

Artificial Hand.—There are two methods of making movable fingers for an artificial hand. The simpler method is to make them with mortise-and-tenon movement. That is cosay, four silts are cut in the wooden hand as mortises for the lower thirds of the four fingers, and these have tenons cut on them to fit into the mortises. These joints are then carved and glasspapered until they work freely without being loose enough to shift with the weight of the fingers. The middle thirds are then fitted in a similar manner to the lower thirds, and then the finger tips. The thumb is mortised into the side of the hand. Steel pins hold the joints together. A kid glove covers the whole. Very little skill is required, and the only tools needed are a fine tenon saw, a narrow chisel, and as bradawl, together with a good pocket-knife. In the other method rule joints are used, and these require more skill in making and fitting. The best wood is willow.

willow.

Flexible Paint for Canvas.—Below is a recipe for a flexible paint for canvas. Mix 1 part of holled oil, 3 parts of raw linseed oil, and 1 part of copal varnish, adding to obtain a flesh colour, 2 parts of yellow ochre and 1 part of venetian red paint. Apply it by means of a heavy brush, allowing one coat to dry thoroughly before applying the next. The drying may be hastened somewhat by hanging the canvas over a line in a room having a temperature of 110° F. By adding suitable pigments any colour may be obtained. For black, use lamphlack; for yellow, use yellow ochre or chrome yellow; for brown, use vandyke brown or Turkey umber. The use of the pigments does not materially alter the method of applying the preparation. Another method is to melt loz. of our rubber in 1pt. of raw linseed oil by boiling over the fire, afterwards adding 1pt. of boiled oil and 1pt. of carriage varnish; stir well together and add the colouring matter. Apply as before. If one coat of the preparation is not sufficient to give the desired effect, the operation may be repeated. Both of the above methods give satisfactory results and make the canvas elastic durable and quite waterproof.

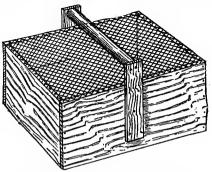
Cementing Indiarubber Articles.—For repairing

Cementing Indiarubber Articles.—For repairing articles made of rubber, rough well with a rasp the parts that are to be stuck together, then with a clean brush

remove all the dust. Now apply to each of the materials a cost of indiarubher solution (obtainable at any cycle stores), and when nearly dry (the solution dries quickly in dry or warm weather or in the warmth of a fire, hut open-air drying is best) give a second coat, and then a third. The solution should be laid on evenly all over with the second finger, and in testing to see whether the solution is dry enough, use the finger, but only in the centre of the surface of the material, for if touched at the edges it will not adhere. The solution is dry enough when it just sticks to the finger without any coming off.

Essence of Coffee.—Essence of coffee may be made by boiling 1 lh. of coffee in 1 gal. of water in a copper still, the volatile oil passing over with the water through a worm. The infusion should be carefully filtered, evaporated to about one-fifth its hulk in a vacuum pan, and the volatile material from the original washing added to it previous to bottling.

Travelling Case for Live Chickens.—The illustration shows a wooden case for conveying from six to twelve chickens from one to four weeks old. The sides of the case are made of 7-in. by ½-in. deal, and for twelve birds the size inside should be about 1 ft. 4 in. by 1 ft., or for six chickens I ft. hy 8 in., but this may be modified according to the breed and age of the birds. Two pieces of deal



Travelling Case for Live Chickens.

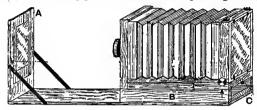
stand up 2in. by 1in. are nailed to the sides of the box to stand up 2in. above the top, and a round stick is fitted between them to form a handle. The bottom may be of the same material as the sides, and both bottom and sides should be lined with soft canvas packed with a little hay. The top is covered with fine wire netting when the birds are being sent off, but in cold weather the top may be partly covered with coarse canvas. The handle in the position shown is useful for preventing other cases being placed on the top, and if desired holes may be bored in the side pieces and a piece of rope stretched across instead of the round wooden rod.

Cement Backing for Thin Copper Panels.—The operation of backing thin copper panels is one that will require considerable care, as the ornamental face of the panel is easily damaged. A cement that can he recommended is made of the best plaster-of-Paris mixed with water in which alum has been dissolved. The plaster should be sufficiently thin to run easily. Pour the fluid carefully over the back of the work, letting the plaster fill the hollows, and then level up the plaster to the desired thickness. This, when hard, will form an excellent cement backing. A mixture of pitch and sand also makes a very good backing, but must, of course, be hot when it is run into the panel.

Painting Mailcart.—The proper method of painting a mailcart is as follows. Rub all the woodwork with No.0 sandpaper, dust well, and apply a coat of white-lead priming, made by mixing genuine white-lead with 2 parts of oil and 1 part of turpentine, and adding a little patent driers. Allow the priming to dry, then putty-up with putty made from equal parts of white-lead and ordinary putty. When this has thoroughly dried, again rub smooth with sandpaper, and dust well. Then apply a coat of spirit colour, made hy mixing 1 h. of the desired colour ground in turpentine, adding more turpentine until the required consistency is obtained, finally adding loz. of gold size, or sufficient to bind the colour and paper, and dust well, as before; then apply a coat of copal varnish; allow it to dry, and line it the desired colour with a coat of carriage varnish. This method will finish with a coat of carriage varnish. This method will give a smooth and very brilliant finish that will be durable for a length of time, and that exceeds the results of applying the cheap enamels supplied by iron mongers.

Melting Gold.—Gold, sither pure or alloyed, is melted in plumbago crucibles, either Morgan or Doulton, Before using the crucible, well rub the inside with flour Before using the crucible, steller Morgan or Doulton, before using the crucible, well rub the inside with flour charcoal to smooth down any irregularity in order that the gold may not be held in and lost. To anneal the crucible, place it in a furnace whose fire has nearly gone out, or else over a fire in a furnace, and weigh out the gold and other metals if such are being used. When copper is added, this must be placed at the bottom of the crucible and covered with a layer of charcoal to prevent undue oxidation. When the metal is well melted, stir with a clean plumbage or smooth iron stirrer; the metal is then ready for pouring. If only gold, which may contain slight impurities, is being used, a small quantity of sal-ammoniac should be added; this will purify and toughen the gold so that it may be well worked. The heat required to melt gold satisfactorily can be learned only by experience.

Brown Tones on Photographic Dry Plates.—The following is a description of the process by which brown tones can be obtained on a dry photographic plate. The plate, after the usual thorough washing, should be immersed in uranium nitrate 50gr., potassium ferricyanide 50gr., acetic acid \$0z., water 100z. After a few moments' immersion the colour of the image will be changed to a warm sepia, and will change again to a bright red if the action is allowed to continue. On removal from the toning bath place the plate in a 1-in-80 solution of acetic acid for a few moments, and then wash in running water for half sn hour. See that the potassium ferricyanide is in good condition, and wash it with cold water before dissolving. Dissolve the two salts separately, each in half the water, and pour the potassium salt into the uranium. The solution will not keep. A positive transparency to be used as a proef may easily be made from a negative by placing the negative and dry plate film to film in a printing frame



Apparatus for Producing Photographic Proofs Ouickly

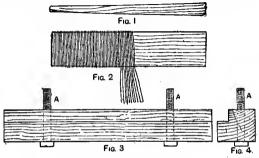
and burning a wax match 18 in. away. Develop in the usual manner. When a proof is needed before the negative has time to dry, the negative may be wiped on the glass side and slipped into a frame as shown at A in the accompanying illustration. The camera is then placed in the position provided on the rails B and extended to a point always marked (see arrow), when the image on the focussing-screen will be fairly sharp and of exactly the same size as the copy. Final focussing is done by a screw. The slide may then be filled with a plate or with bromide paper as desired, and the exposure made as usual. The distance between the image and the copy will be just four times the equivalent focus of the lens, or twice the focus between the stop and the copy and the stop and the image.

Inserting New Bent Side in Plano.—The crescent-shaped wood at the treble end of a piano, into which the hitch-pins are inserted, is commonly called the hent side. If this is much worm-saten, it should be replaced by a new one; but this would necessitate nearly one-half of the strings being replaced, and the sonndboard disturbed. If the decay is not very pronounced, its progress might be stayed by frequently saturating the side with wood naphtha, and then planting on an iron plate, with the hitch-pins riveted in positions corresponding with those now occupied in the bent side. A common fault of wood bent sides is their liability to pull off from the glueing, thus causing the treble end to get out of tune. Whether this is the case or not can be readily ascertained by trying to insert a table-knife behind the bent side and the bracings, to which it should be in close contact. If it has pulled away, remove all the movable parts of the piano, including the action and keys, putting them carefully aside to avoid damage. Then turn out all bolts or screws that are holding the bent side on, and slacken out all steel strings till they are free from tension likely to retard the cramps when being tightened up. The instrument should next be turned upside down, with its capping or top resting on the floor; then spring the bent side away at least \(\frac{1}{2}\) in by means of wood wedges, and with a table-spoon pour some hot

freshly made gine into the joint, working it well home with a table-knife. Both utensils should be previously dipped into hot water to prevent chilling the glue. Remove the wedges and put on as many cramps as possible, or if none of these are at hand, and coach screws or dowels have been used, immediately put in some i.ln. bolts with their heads at the front and nuts and washers behind the bracings. Tighten up at once, theu glue stout blocks of wood behind wherever it is possible to get them: see that these fit well, removing any old glue or varnish before fixing them into position. Then allow the instrument to stand untouched for at least twenty-four hours and then tighten up the wires again. Should it be found desirable to put in a new bent side or to put a plate on its face, a careful imprint of the present one should be made before it is disturbed. To do this, take a sheet of brown paper of convenient size, put it over the bent side, and rub gently over all with a cobbler's heelball until it shows a clear imprint of all hitch-pins and the outline of the wood required.

Obtaining Gloss on Ostrich Feathers. -To obtain a obtaining Gloss on Ostrich Feathers.—To obtain a gloss on ostrich and other feathers after they have been dyed or cleaned, they are dipped in an emulsion of olive oil and pearlash, and then moved about in a warm room till they are dry. The emulsion may be made by dissolving 1 lb. of pearlash in 4 pt. of water and stirring this with 4 pt. of olive oil.

Packing Circular Saws.—Circular saw packing is made by twining clean hemp round two slips of wood. These slips should be equal in length to the radius or the semi-diameter of the saw, less the saw teeth. The packing rests on a rebate on each side of the fore half of the saw. The slip on the bevelled side of the saw should be tapered as shown in Fig. 1: the hemp is passed round the slips as shown in Fig. 2. Two pieces of wood, rebated as



Packing Circular Saws.

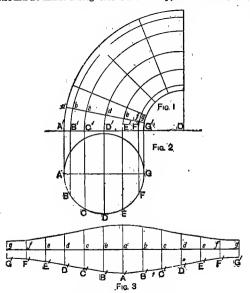
shown in Figs. 3 and 4, are secured underneath the table of the bench by means of bolts A screwed into tapped holes. On these pieces the packing rests. The hemp is so passed round the slips of wood that more warmth is conveyed to the centre of the saw-plate (when passing between the packing) than at any other part. The warmth caused by the packing should decrease from the centre out; at, and near the rim, the plate should be cool. Undue heat on the outer part of the plate will cause the saw to run out of truth and to become crippled.

Panny-in-the-slot Gas Meter.—The penny-in-the-slot meter is made differently by various firms, but the principle of most is the same. A worm fixed on a shaft is free to travel axially upon the shaft, but when the shaft is revolved the worm must revolve with it. Connected to the worm and gearing with the threads upon it is a pinion, which can only be revolved by the handle when a penny has been inserted, and has thus formed a connection between the handle and the pinion. formed a connection between the handle and the pinion. The turning of the pinion causes the worm to travel axially along its shaft, as the threads of the worm act then as a rack. In travelling, the worm opens the valve and allows gas to pass through the meter. The passage of the gas through the meter revolves the ordinary indicating mechanism, and this motion is also conveyed to the shaft of the worm through gearing which can be changed according to the number of fest of gas desired to be given for a penny. The revolving of the shaft causes the worm, which is in gear with the pinion, to travel in the direction opposite to that in which it was carried on the turning of the handle, and in this travel it closes the valve, and when the quantity of gas paid for has been consumed the valve is entirely closed and the passage of the gas stopped.

Preventing Rats Eating Leather.—To prevent rats

Preventing Rats Eating Leather.—To prevent rats from eating leather, make a paste of 1 part of verdigrie and 2 parts of olive oil, and rub it well into the leather. This paste is poisonous and will be a preservative.

Making Bends in Zinc.—Square, obtuse, or acutangle bends in zinc are stamped and stocked in all diameters by big firms, and the machine-made bends are much cheaper than hand-made goods. To make a bend by hand in, say, four pieces, first draw a side elevation of the desired size, with the opposite ends making the desired angle, as shown by Fig. 1, also draw the plan of one end (Fig. 2). Divide the lower half of the plan into any suitable number of equal parts, as A B, etc. From each division point draw projectors to reach the ground line, and then using 0 as a centre, and with radius to A! B!, etc., draw the arcs of circles shown on Fig. 1. Next divide the curves A! G! (Fig. 1) into a number of divisions, corresponding to the anumber of sections of which the bend is to be formed. Join these division points by straight lines, and subdivide the first section (Fig. 1) by the line ag. Now set off upon a straight line a number of equal divisions corresponding to those shown on the plan, as abc, etc. (Fig. 3). The length of this line would correspond to the distance round the section on the line ag on the elevation. Through abc, etc. (Fig. 3), draw lines at right angles bc, and on both sides of the centre line. Take the distance aA^1 on the elevation, and set off on each side of the centre line of the pattern accus accus accus accus and <math>accus accus accus accus accus accus accus through the sat <math>accus accus ac



Making Bends in Zinc.

end of the pattern, so that when the section is bent round a lap seam could be formed. When making a bend of this type the sections are slightly hollowed npon a wooden block along their length, and after turning the section round, and soldering the ends together, a small edge is thrown off round one end, so that the section joining it laps over this small edge, and it is then soldered in position. The roughness at the soldered parts is removed by cleaning the spare solder off the zinc with a sharp scraper.

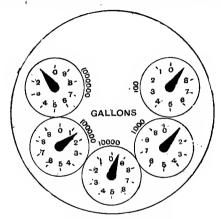
off the zinc with a sharp scraper.

Softening Hard Photographic Enlargement.—In the case of a photographic enlargement being hard owing to under exposure, it may be softened by reducing. If the original showed too great contrast, the enlargement should have been very slightly overexposed in order to bring the higher and lower gradations closer together. A better negative would probably have been secured by giving the same proportional exposure but using a rapid instead of a slow plate; this would have had the effect of softening the contrasts. Advice on such matters is always difficult to give without an inspection of the negative; but possibly the best way of dealing with the existing negative (if another cannot be made) would be to coat the back of the plate with matt varnish and then scrape this varnish away from the dense parts of the plate. The bromide enlargement may be reduced either with

ammonium persulphate, or by converting some portion of the silver image into silver iodide and dissolving out in sodium thiosulphate. The former method may prove the more effective of the two in unaccustomed hands, because being done in one operation there is less chance of error; and this reducer possesses the additional advantage of being the only one that attacks first the denser deposits of silver; and thus in reducing the image reduces also the amount of contrast. Soak the paper till it lies flat, and transfer to a 2-per-cent, solution of ammonium persulphate till the desired reduction is obtained. Then place the paper for five minutes in a 10-per-cent, solution of sodium sulphate, and finally wash for ten minutes. New developer gives an image of a better colour with increased contrast generally. The developer referred to will keep for a considerable time even atter mixing with the alkali, but, in order to avoid obtaining images of a brownish colour, the developer should be discarded directly its action becomes noticeably slow.

Scents for Wardrobes.—With regard to scents for placing in wardrobes with clothes, ordinary scents are not very durable, as they are very volatile and easily evaporate. A lasting scent is that of lavender flowers, which may be kept on a small tray. Orris powder also gives a very pleasant odour.

Reading Water Meters.—The dial of the "Imperial" meter is here shown. The arrangement of pointer is similar in most meters. The reading commences with the circle to the left, which contains the highest figures, and the figure to he abstracted is the one beyond which the pointer has travelled. It will be observed that the pointers in the first, third, and fifth circles



Dial of Imperial Water Meter.

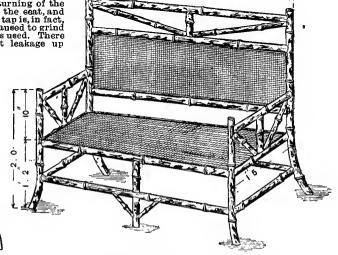
move from right to left, and those in the second and fourth from left to right. The dial reading in the illustration is 1,190,900 gal. In the Kennedy meter the circles and pointers are in a row, like a gas meter. The Kent "Positive" and several meters have the straight reading dial.

The Kent "Positive" and several meters have the straight reading dial.

Press for Extracting Liquids from Herbs.—A suitable hand-press for treating herbs can be constructed as follows. The base of the stand should be a wrought or cast-iron plate 8in. by 8 in. by 1 in. To this should be bolted at opposite sides a ¬shaped wrought-iron band carrying a female screw thread in the centre, through which would work a spindle having a thread; to the upper part of the spindle two handles should be attached for turning the screw. This portion of the press will be somewhat similar to a copying press. To the lower end of the spindle should be attached a circular cast-iron plate 6in. in diameter; this will work within a sheet copper cylinder 6in. in internal diameter. At the side of the copper cylinder, and near the bottom, a hole should be drilled, and just below this hole a spout should be soldered so that the liquid will flow out into a hottle below, the press being fixed on a wooden block of a convenient height to allow the bottle to be placed in the proper position. The herbs containing the spirit should be placed in the copper cylinder and pressure gradually applied. This is a common form of tincture press, but if difficulty is experienced in making it a lever would do in place of a screw. Or a simpler form of press can be made with a wood frame, the herbs being placed in a linen bag, and pressure applied by means of two boards placed in the frame and forced together by a wedge.

Roof Tiles and Tiling.—Plain tiles are rectangular slabs of hurnt clay, generally about 10 in. long, 6 in. wide, and ½ in. thick. They are laid on fir laths nailed to rafters, being hung from the laths by oak pegs driven through holes near the upper edge of the tiles. Sometimes, instead of using pegs, little projecting cogs are formed on the upper edge of the backs of the tiles, by which they are hung on to the laths. The arrangement of the tiles is similar to that employed for slates; the tail of each tile rests upon the tile below for a length of ahout 6 in., the gauge being 4 in. and the lap over the head of the tile next but one below about 2 in. In exposed places each tile is bedded upon the one helow it in hydraulic mortar or cement. Tiles require heavy roof timbers, as they weigh more than twice as much as slating—say 1,800 lb, per square against 700 lb. The larger tiles, called pantiles, are only used for common work; although larger, pantiles only weigh, when fixed, two-thirds the amount of plain tiling, owing to the smaller number of laps.

Kelvin Water Tap.—The illustration shows the mechanism of the Kelvin patent water tap. A is a composition valve or seating which closes down on the seat B to shut the cock. When A comes down on B, A does not come to a stop, as in ordinary cerew-down tape, but is seated gradually, receiving meanwhile a gradually increasing pressure from the spring C, applied through the rounded head of the rivet stop D. The turning of the spindle revolves the valve or seating upon the east, and both thus maintain an even curface. The tap is, in fact, a cock in which the seating and seat are caused to grind and true themselves every time the cock is used. There is no packing or stuffing box to prevent leakage up



Bamboo Settee for Garden.

through the stem of the tap. Instead of this any water that passes upwards enters the space E, round the spindle of the tap, and is drawn away through the eduction or ejector tube F by the rush of the water through the nose of the tap. This tube is only used with bib cocks. With stop-cocks the ejector tube does not answer, and a stuffing hox is provided. The chief difference, therefore, between this and other screw-down cocks is that the seating and seat, when they come together, do not stop dead, but the seating still revolves a little, and this has the effect of keeping the cock true and water-tight for along period. The makers guarantee the cocks for three years, whereas, in a busy house, an ordinary tap will scarcely last one year.

Kelvin Water Tap.

Repairing Bellows of Pipe Organ.—For valves, a soft finish leather, and for strapping, a stout, strained skin are used. The glueing should be done in a warm place, and the leather of the bellows edges must be well rubbed down with a bone or ivory tool. Hot water and a sponge are used to restore warmth and to clean the work. Paper patterns should be cut for gussets, and the edges should be pared round the margins of the leather before glueing on. All woodwork that is to be covered with leather must have the sharp edges removed. All old leather that is to be replaced must be completely cleaned off, but first examine it carefully, to observe the order in which straps, angle-pieces, and gussete are fixed. In making feeders the ribs are first joined in pairs with linen tape outside, the joint and leather being inside. The top and bottom boards have a şin. margin marked on; strips of leather are glued on so that the leather overlaps the edge of the inner surface, but has the \$\frac{1}{2}\$-in margin of board unglued. This is done by applying the glue up to the line, the leather then being applying the glue up to the line, the leather then being

put in place and a warm flat-iron used to make the leather adhere where needed. The ribs are fixed temporarily, and the overhanging leather is glued over their edges. Auchter strip completes the joint. When all is done and dry, the gussets and corner-pieces are fixed. The inward folding ribs of the reservoir are done in the same way, but "inverted" ribs of the reservoir have the pairs of ribs joined together with tape on the inside. The valves should he made of stout soft leather, as two thicknesses of leather are apt to curl through the glue uniting them being affected by the weather. Bamboo Settee for Garden.—The accompanying illustration shows a strong, light settee for both, indoor and outdoor use. If it is to be exposed to all weathers, marine glue should be used in constructing it, and two coats of outside varnish should be applied instead of the spirit varnish used for inside purposes. The bamboo should not be less than 1½ in. thick, and the back and front frames are made first, dowelled in the usual way, and are then consected by the six short rails as shown. The centre or seat rails of these will be 14 in. long, the upper ones being § in. longer and the lower ones I in. longer. In

- 3 o "

putting in the centre front leg the dowel should go right through the lower rail into the top one, and the corner supports are put on after. The seat, which will be 35 in. long by 14 in. wide, is of \$\frac{3}{2}\$ in. board, and will require a batten screwed on at each end on the under side. The back panel will be 35 in. long by 11 in. wide, and is also of \$\frac{3}{2}\$-in. board, and this and the seat are covered with Chinese matting, secured in place with \$\frac{3}{2}\$-in. screws through the rails, and beaded with \$\frac{1}{2}\$-in. split cane. Turned wood terminals are then put on the four top ends.

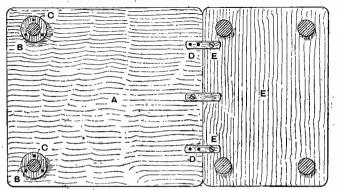
Manufacture of Wood Matchboxes.—In making matchboxes of the "drawer" type much machinery is used; the wood is taken on to the machines in the green state as it comes from the forest, and cut into planks that are as thick as the box is to be long. Thin veneers are pared off from the planks by a specially designed machine; each slice of veneer, or "skillet" as it is termed, is immediately conducted under a sprockst-like appliance which cuts off portions the correct length for a box, and at the same time scores four lines across each section at the places where the corners are to be bent up. The actual folding and covering with paper is in most cases done by hand, but there are several machines in which these processes are done mechanically. The round matchboxes used in the United States are turned by machinery, one machine making the box and another the covers, though either machine can be made to turn out about 10 gross items in an hour. The boxes are taken from the lathes and rattled in a revolving cylinder, which cleans and polishes them and separates them from chips, etc. The wood used in these boxes has previously been kiln-dried.

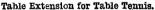
Laying Lineleum on Rough Floors.—When laying in the first place a liberal layer of ordinary sawdust, taking care that there are no chips of wood or any other rubbish among it. The sawdust may be spread roughly by means of a lath of wood. The lineleum is then put on the top and fastened at the edges in the usual way, and after a short time the sawdust will work its way into the hollows and the result will be a perfectly level surface. This method gives a softer feeling than if laid direct on the floor. In fixing lineleum it makes a better joh to glue the edges than to use tacks. If good thick warm glue is used it will stick sufficiently well either on stone or wood, and the lineleum can he litted when wanted without tearing it.

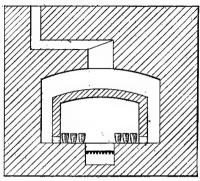
Table Extension for Table Tennis.—The following Table Extension for Table Tennis.—The following is a description of an extension made to an old mahogany dining table to render it of suitable dimensions for table tennis. The upper portion of the top A in the illustration is made of matchboarding of suitable size and of the same thickness as the table to which it has to be attached. This board may be painted or stained to match the colour of the existing table. Only two legs Barerequired, and these fit into sockets of glued or nailed to the under side of the board as shown; thus the legs can be removed. The two connecting bars D should be of hard wood, 6in. by lin. by lin., having holes about 1 in. in diameter. The holes through which these hars are screwed to the table-top E are about 2in. from the edge, so that when not in use afterwards removed with warm water, as in the carbon process, leaving those portions of the zinc beneath the shadows of the negative covered by an insoluble film. The plate is then stood aside to dry, and afterwards heated to such a temperature as to make the fish glue acid-resisting. The plate is then etched or eaten away by an acid to the proper depth, and trimmed and mounted on a wooden block type high. A certain amount of handwork bestowed both on the original and on the block by a skilled worker is an improvement.

block by a skilled worker is an improvement.

Animal and Bone Black.—Bone black has a variety of uses, but is chiefly employed for decolorising sugar, and for the manufacture of paint and blacking. The black is prepared by calcining or charring bones in a closed vessel. There are two processes, one for collecting the volatile products, and the other to allow the volatile, products to pass over. The latter process is almost entirely used, as the oil collected in the former process is of no practical value. The oil obtained is known as Dippel's or hone oil, which is used on the continent for denaturing alcohol (methylated spirit). In preparing bone black by the second process, the hones are first broken by machinery into small fragments and placed in small clay crucibles, having a cover placed over to prevent the black from Igniting. In these covers are small holes to allow the volatile matter to escape. The crucibles are then placed in the furnaces ready for heating the crucibles. A sketch of a furnace much used for this purpose is shown herewith. The furnace







Furnace for preparing Animal and Bone Black,

the bars may be turned round underneath the table, and thus be out of sight. They should be 2 in. from one end of the bar. The other holes should be 1 in. and 2 in. respectively from the centre of the har, and are for the exception of the projecting pins in the under side of the extension A. The middle bar should be 4 in. by 1 in. by 8 in., and is pivoted on the under side of the extension. To connect the extension A with the table E, turn the bars D round so that they project at right angles to the edge of the table, and in the holes insert the projecting pins of the table extension. These pins may be screw nails with their heads cut off. Turn the middle bar round so that its outer end may overlap the under side of the table; thus the two parts will be rigidly held together.

Reproduction Half-tone Process.—The photographic half-tone process of reproducing photographs, wash drawings, etc., is one that is outside the scope of amateur work except for experimental purposes. Blocks are now made commercially at a price considerably lower than they can be made occasionally, and certainly with more satisfactory results. Briefly outlined the process is as follows. From a silver print a copy negative is made on a process plate or by the wet collodion process in order to get a negative showing extreme contrasts with clear shadows, as the tendency of the process is to give a flat result, particularly in the lighter tones. In front of the plate, at a distance that is readily adjustable, is placed a glass plate ruled with lines (generally about 100 to 150 per inch in magazine work), the number per inch depending upon the method of printing and the paper that is to be used. This glass plate is technically called a "screen," and its function is to split up the tones of the photograph into dots of varying size—that is to say, each opening between the lines forms on the plate a pinhole image of the stop. In the lighter portions the dots are small, and in the shadows larger and therefore closer together. A bichromated film of fish glue on a slab of zinc or copper is then exposed behind this negative and the soluble parts

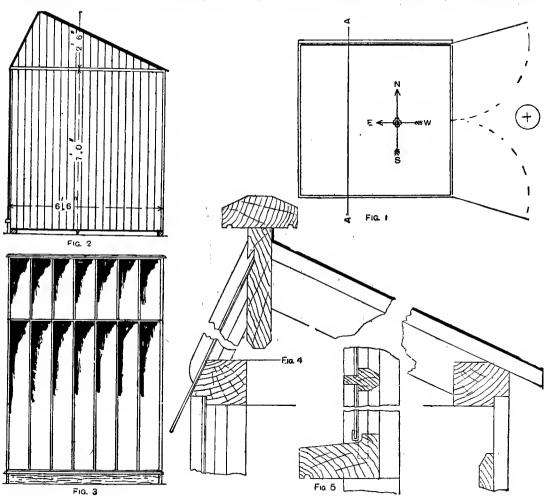
has a large flat hearth about 20 ft. long by 14 ft. wide, in the centre of which is fixed a fireplace, which is arranged to be fed from the outside; a firebrick arch is built over the hearth, at the hottom of which are a number of flues to carry away the products of combustion. Doors are also built in the sides of the furnace to admit of the furnace being charged and emptied. The number and sizes of crucibles vary according to the size of the furnace, then the size of the furnace to admit of the furnace, then the crucibles are placed in the furnace, the doors are secured and the temperature is raised slowly to a red heat, which is maintained for ahout seven hours, after which the furnace is allowed to cool down. The crucibles are then taken out and allowed to get quite cold before opening them, otherwise they are liable to ignite spontaneously, leading to a loss of material. When the furnace is emptied, it is ready for a second charge before it is altogether cold, which is a saving in fuel. Two and sometimes three charges of black may be obtained in one day, each charge being from 5 to 10 ewt. and yielding from 57 to 60 per cent. of its weight of black. The black when taken from the crucibles is ground very fine under flat stones with water, after which it is dried and powdered ready for use. If preparing it for decolorising purposes, it is ground into coarse granular pieces. Its chief use is in blacking manufacture, owing to it containing large quantities of calcium phosphate and carbonate originating from the mineral constituents of the bones. It may be mentioned that the spent black from sugar refineries would, if powdered, be found the cheapest form of black, its price being from £5 per ton. price being from £5 per ton.

Preservative for Studwork in Roughcasting.— Studwork is sometimes coated with raw oil, crecoste, black varnish, coal tar, carholineum avenarius, and Stockholm tar. All these preparations act as preserva-tives. The question is simply one of cost and appear-ance. Stockholm tar and raw oil will be found most effective.

Soldering Leaded Lights Together.—For soldering the calmes of a lead-light window, all that is necessary is to fit the calmes properly together, then shave a small round dot at the point of junction, sprinkle a little powdered resin on the shaving, and with a copper bit, or a glazier's iron with a tinned face, melt a small pieces of tinman's ordinary solder on the shaved part so that it tins to the lead and forms a round hutton.

Combined Summer-house and Studio.—The illustrations show the construction of a combined summer-house and photographic studio, suitable for small gardens. The size is 6ft. 6in. by 6ft. 6in. by 7ft. high to the plate, the roof rising 2ft. 6in., including the capping to the ridge.

Quick-drying Black Paint for Stove Pipes, etc.—Brunswick black and black japan will be found useful for stove pipes and similar work. If slightly warmed over a fire and applied hot, it will dry hard in a few hours with a good gloss. The following preparation will be found inexpensive, and easy to prepare; also it dries hard, and does not smell when used on heated surfaces. Melt in an old iron vessel 4½ lb. of asphaltum, allow it to remain over the fire about an hour, stirring at intervals; then add slowly ½gal. of boiled linseed oil which has been previously warmed, following with ½lb. of finely powdered litharge, which should be steadily sprinkled in while continually stirring. Allow the preparation to boil about half an hour until some, when taken out and



Combined Summer-house and Studio.

The proper position for the house is as shown, the roof and side lights having a northern aspect. On the western side a pair of doors is arranged to open outwards, the position of the operator and camera being indicated by the cross enclosed in a circle (Fig. 1). The side light runs down to within 6 in. of the floor. The sides of the house are covered with ½-in. matchboarding, the doors being made of similar material with ledges on the inside. The roof is covered with matchboard and felt, or, instead of the latter, light corrugated iron may be used. If the house cannot be placed in the position shown, the situation may be reversed, but the light should always be obtained from the north if possible, otherwise the inside must be fitted with Blinds to subdue the light. Fig. 1 is a plan of the house, Fig. 2 is a section on line AA (Fig. 1), Fig. 3 is an elevation facing north, Fig. 4 is a detail of the roof, and Fig. 5 is a detail of the sill to the side-light.

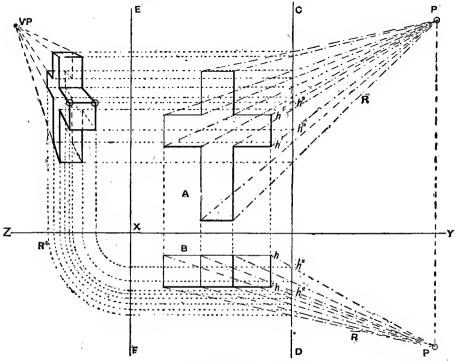
slightly cooled, sets hard between the fingers. Then remove the preparation from the fire, allow it to cool somewhat, and add, while constantly stirring, 29 gal. of American turpentine. Allow the mixture to stand several days, when it will be ready for use. This preparation dries hard in two or three hours with a hard, lustrous surface.

Rubber Tyres Cracking.—With regard to the treatment of cycle pneumatic tyres that are cracking near the rim, if the rubber is not worn out on the tread of the tyre, thoroughly clean round the edges where cracked with a brush and benzoline. Then brush into the cracks thick rubber solution, and, when dry, dust over with French chalk. This will keep the wet from the canvas lining until the rubber coverings of the tyres are destroyed to such an extent that re-rubbering is the only possible repair.

Finding Perspective of an Object.—The following is a very simple method of finding the perspective of any object. The plan and elevation of the object (in this case the object is taken to be a cross) are obtained as shown by A and B, and the position of the eye is marked at the required distances from the vertical and horizontal planes as indicated by P and P¹. Every point is then connected to the eye in plan and elevation as shown by the lines R and R¹ and the position of the picture plane inserted at CD. An auxiliary picture plane is then put clear of the plan and elevation as shown at EF. This plane is not absolutely necessary, as the rays could be swing round from the original picture plane, but then the perspective would overlap the elevation and cause confusion. The points where the rays R in plan cut the picture plane C D are then projected across to the plane EF and swung round to the ground line as R², the centre of the curves being at X. Then the points where the rays R¹ (elevation) cut the picture plane C D

Previous to moulding, the gelatine should be softened by steaming, placed over the holes in the mould, and forced in by the plugs. After ahout an hour the gelatine will be set; the plugs may then be removed, the excess of gelatine shaved off with a sharp knife, and the cases shaken out. The capsules are usually double, one sliding within the other; this will necessitate two moulds, one with holes about he in smaller than the other. If wood moulds are employed they should be oiled to prevent the gelatine sticking.

Hardening Plates of Lawn Mower.—The method of hardening lawn mower cutting plates depends on whether they are of English or foreign manufacture. The majority of English plates are made somewhat similar to a skate-blade—that is, with a layer of iron between two layers of steel. To harden such plates, get them to a hlood-red heat, grip them in the centre with a pair of close tongs, and plunge them in the water edgeways, moving them about till cold, but taking care to



Finding Perspective of an Object.

are projected horizontally to intersect the vertically projected rays \mathbb{R}^2 . The correct points can easily be determined by following each point carefully. For instance, the four points represented in plan and elevation by h and h^1 , are connected to P and P^1 and intersect at h^2 and h^3 . Take the top points h^3 and project across to cut the projections of the two points h^2 , thus obtaining the two points encircled in the perspective. The two lower can be obtained in the same manner, thus forming the square in the perspective. All the other points should be obtained in a similar manner and the whole object then filled in. In the illustration there is only one vanishing point, V P.

Gelatine Capsules.—For making gelatine capsules, the necessary appliances are a mould and cores or plugs to fit it. The mould should be made of brass, but a wood one might serve for trial. It should have several (say two dozen) holes bored in it, each hole having the diameter and depth of the capsules required and being rounded at the hottoms. The plugs should be made rounded at the hottoms. The plugs should be made rounded at the hottoms. The plugs should be dissolved in about an equal quantity of water and, while hot, poured on a polished marble slab and allowed to cool. When set it should be cut into convenient sized pieces, allowing for shrinkage, the amount allowed heing determined by experience; the pieces should then be dried in a warm place.

move them so that they go through the water edgeways. In this case the layer of iron helps to keep the blade to its original shape. The majority of foreign plates are made of a different kind of metal, and to harden them without warping they must be cramped between two pieces of iron, made hot, and cooled out as in the former case. It is no drawback to a plate if it is slightly warped, for with a little packing when heing screwed on it can be brought perfectly true. Some repairers do not trouble to re-harden the plates, as they can be obtained very cheap ready hardened.

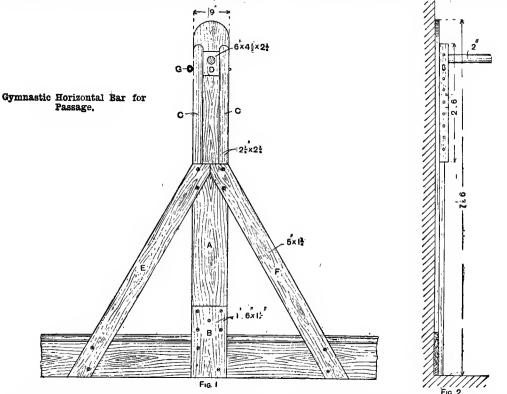
Re-wiring Spring Mattress.—Re-wiring a woven-wire spring mattress is practically the same job as making a new mattress. First the wire is stripped off and a new weh is woven. Specially prepared tinned hard-drawn wire for wire mattress making costs 20s. per cwt. It is coiled in long ribbons of various pitches as required by a mattress-weaving machine, and is then worked in slngle, double, or trehle layers on a large bench till the desired width is obtained. The wire web is then nailed on the end bars of the mattress frame and pulled up tight by the cramp bolts. Chain-spring mattresses are not as durable as woven wire, being much cheaper; they have no means of adjustment for taking up sagging, and are usually fitted to iron frames, each chain or spring wire being sprung into position and secured to the frame.

Selentite Lime for Plastering.—Selentite lime is sulphate of lime added to ordinary lime; the advantages of its use are that the setting is made more rapid, and the proportion of sand that may be added is increased. In three-coat work, for the first coat the proportions are 1 part lime to 3 parts clean, sharp sand; for the second or floating coat. 1 lime to 4 sand; for the third or setting coat. 2 lime to 3 sand, with a hod of ordinary lime putty to each bushel of selentite lime. The only precautions to take are to mix in small quantities, and apply speedily.

apply speedily.

Gymnastic Horlzontal Bar for Paseage.—Figs. 1 and 2 show front and side elevations of a simple arrangement for fixing a horizontal bar in a passage. Two such uprights will be necessary. The wall piece A lodges on the top of the skirting, and is lengthened out by a piece B, the two being securely screwed together. The two slides C should be bored as shown. Each of them should then be secured to the wall piece by half a dozen 3-in, stout screws. The blocks D should next be bored to receive the end of the bar, and also

a temperature of 275° F. is reached, when steam is blown into the still. The turpentine begins to pass over and condenses with the water by being sent through a spiral or worm condenser, and is then run off into large vats or tanks, the water being allowed to settle to the bottom. The clear turpentine is now run off and if necessary subjected to further distillation. Chemically, oil of turpentine consists chiefly of a hydrocarbon named pinene, and also contains traces of oxidised compounds and organic acids. One of its many psculiarities is that it rotates a ray of polarised light to the right, whist the other turpentines—French, Russian, etc.—rotate it to the left, these facts often being used in a practical method of distinguishing one oil from another. After exposure to the atmosphere, oil of turpentine becomes slightly thicker and of a higher specific gravity. The organic acids it contains will often cause corrosion of the iron receptacles containing the oil. Turpentine has the property of giving up the oxygen it has absorbed to other bodies inclined



bored right through their breadth, so that the bar can be held in position by the iron pin G. Two struts, E and F, must be fixed to the wall board with screws. The whole support can then be attached to the ekirting of the passage by six stout screws. If it is desired to make the uprights more portable, so that they can be quickly removed, they can be connected to the skirting by means of thumbscrews. The wall board should be of red deal, the slide pieces and adjustable blocks of ash, beech, or oak, and the bar of ash.

ash, beech, or oak, and the bar of ash.

Turpentine.—American turpentine, commonly known as spirit of turpentine, is obtained from several species of pine trees, which grow abundantly in the forests of the United States, principally in Carolina and Georgia. The Georgia pine yields the largest quantities of turpentine. During the winter months incisions about 3 in. deep and 9 in. from the ground are made in the tree, and from them the resin flows into suitable receptacles. This resin is commercially known as gum thus, and in its crude state is much used in the preparation of spirit varnishes and polishes; the bulk of the resin, however, is placed in stills for the manufacture of turpentine, after which it is known as "resin" or colophony, which comes to the market in various shades ranging from "pale glass" to black resin. To extract the turpentine the crude resin is placed in stills holding about 70 gal. It is then heated until

to become oxidised, and in recent researches has been found to absorb one hundred times its own volume of oxygen at 100°C. thus becoming an excellent factor in the preparation of varnishes. Owing to its high price, there have been in recent years many attempts to prepare a substitute, but all have been more or less unsuccessful. Amongst the substitutes were compounds or fractional distillates from petroleum, henzole, coaltar naphtha, shale, and resin spirit, which were mixed in variable proportions with the French and American turpentine, and were sold under various names, as patent turpentine, turpenteen, Chinese turpentine, turpentine oil, etc. They were produced in a highly rectified form, particularly the so-called Russian turps, which, by skilful mixing, was made of a specific gravity almost identical with that of pure American turpentine, and also with high flashing points. These substitutes, however, dry badly when mixed with paints or used in the preparation of varnishes, the work, after being executed, remaining sticky for an indefinite time, because the benzole, petroleum spirit, etc., fail to absorb oxygen from the air. Adulterants are easily detected in the laboratory, but the painter and drysalter may test a suspected sample by slightly warming it and comparing the smell with that of a standard sample of pure American turpentine treated under similar conditions.

Paste for Labelling Tin Boxes.—The following is a satisfactory recipe for paste to be used in labelling tin hoxes. Make the paste in the same way as the ordinary flour paste, but use syrup in place of water. Make the syrup hy boiling two or three large teaspoonfuls of West India sugar in a teacupful of water; when the syrup is cold stir into a small quantity of syrup sufficient flour to form a paste of the consistency of cream. To this add some boiling syrup and stir vigorously; now boil the mixture and continue stirring until the stick or spoon used will stand in the mixture; lastly add from eight to ten drops of carbolic acid to prevent the paste becoming mouldy. mouldy.

Moulay.

Octagonal Table.—Fig. 1 is the side elevation of a small octagonal table whose height is 2ft. 5in. The table top is made from ‡in. stuff and may be shaped from a piece about 18 in. square, Fig. 2 showing the underneath plan. A piece about 16 in. by 5 in. by 1 in. is mortised and shaped as shown at A (Figs. 1 and 2), and is fastened under the top by means of sight screws. A block 2in. thick, shaped from a piece about 12 in. square to the form shown in Fig. 3, has also a mortise in its

stripping, sither the print is not pericetly ary or the glass has had an uneven and too thin application of wax.

Cleaning Waterbury Wateh.—In the older class of Waterbury watch, that is, the long wind, on removing the case at the back the words "Don't remove this unless you are a practical watchmaker" will be seen. Now the only reason for this warning is that the very long mainspring may fly out all over the room. Therefore hold the cover down with the thumh until the three screws are removed; then geutly lift it so at to slip the blade of a knife acrose to keep the spring in position. When taking away the cover, look at the outer coil of the spring to notice particularly how it is arranged to act as a stop when the watch is wound up. Then unhook the spring in the centre or inner coil. To save two wheels an exceedingly long spring is used. Before unscrewing the movement top plate, and after it is well brushed and cleaned, the pivotholes are cleaned with pointed pegwood. Replace the few wheels in position and put on the top Fig. 3 FIG. 2 <n Octagonal Table.

centre. The mortises in Figs. 2 and 3 are to receive the tenons shown in the pillar B (Fig. 1). This pillar is octagonal, and tapers from 3½ in. at the bottom to 2½ in. at the top. The tenons are driven snugly into the mortises, and well wedged and glued. Four feet C (Fig. 1) are made from short ends about 2 in. thick, and are secured to the block D. The table may be made from any kind of wood, and if of soft wood will look well when stained to imitate hardwood. Then apply two coats of carnish size and two coats of varnish.

Glazing Carbon Prints.—In making carbon prints, if the glazed side of an opal is used instead of the ground side the prints will leave the opal with a high glaze. The surface of the opal must, however, be free from the streaks and flaws often met with on the reverse side of ground opal. Glass may be used, nut in such case when to stop development is not easily judged without removal from the bath. Opal glass known as "flashed opal" answers best, but is sometimes difficult to procure. Opal glass specially smoothed can be obtained to order of most dealers in photographic materials. Whether glass or opal is used it must be first waxed with a solution of pure wax 5 gr. pure henzine 1 oz. The wax solution is rubbed over and then polished off with a piece of oiled paper. The glass is then coated with the enamel collodion in the same way as a negative is varnished, and, having set, it is then washed until all greasiness has disappeared; this is done to get rid of the two solvents, alcohol and ether. The enamelled plate is next laid face up in a dish of cold water, and a sheet of the printed tissue

(somswhat smaller than the plate) is also immersed. The two are withdrawn together (face to face) in the usual manner, laid on the mounting slab, and squeegeed by gentle, firm pressure into close contact. The plate is then developed in the ordinary way, fixed, washed, and squeegeed into contact with its final support. Stand to dry in a well-ventilated room, and when perfectly dry the print and collodion will leave the glass together; should the print appear to stick, run a knife along under the extreme edge. If any difficulty is experienced in stripping, either the print is not perfectly dry or the glass has had an uneven and too thin application of wax.

plate, getting the largest wheel pivot in first, next the one that stands the highest, and so on. The 'scape wheel when at rest must point a tooth at the groove in the bar of the balance, and will be in beat. If not, unpin the hairspring and move it, then with best watch cill lubricate each pivot hole at the top and bottom, a drop doing all that is required. Test by pressing the large wheel to see that it beats all right, replace in the case, then the mainspring, and fix the outer coil. Also refix the inner cover with the three screws, replace the hands, which are simply pressed down, drop one spot of oil on the centre at the back, and replace the outer cover. The short-wind Waterbury is easier to clean. By removing the small screw which holds the stem winder in position and the other holding its movement in the case, the work can proceed as already described, except the mainspring, which is in a barrel as in an ordinary watch. There are two more wheels, on account of the shorter spring. Clean well the escapement as above and replace, when either watch will go well. These watches are good time keepers as a rule.

Removing Gloss from Silk and Satin.—Gloss pro-

Removing Gloss from Silk and Satin.—Gloss produced on silk or satin by pressing when making up the garment or occasioned by moderate wear, may be removed as follows. Dissolve a small quantity of powdered ammonia in hot water, allow it to cool (or weaken Scrubb's cloudy ammonia by adding cold water), and in this dip a piece of silk or clean sponge, and with this damp the surface of the material. Next take a moderately heated iron, lay it on its side, cover it with a damp rag, and allow the steam produced to play on the back of the glossed material. The foregoing plan may be safely followed for light as well as dark shades, but the more fugitive the tone or delicate the texture the weaker should be the solution. For black silks or eatins which have become greasy during wear, the ammoniated liquid will be more effective when applied hot or moderately heated.

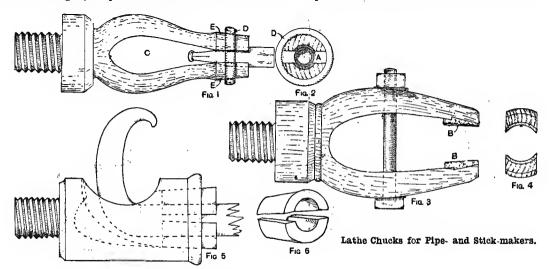
Producing Fire and Smoke for Theatrical Performance.—For producing the effect of fire and smoke at an amateur theatrical performance ordinary coloured fires could be used only where the stage is ventilated. For an ordinary room, the best results would be obtained by throwing on to a red-hot plate a mixture of lycopodium powder and ammonium chloride. The lycopodium yields an immense fiame, and the ammonium chloride produces a great fume. Care must be taken that nothing inflammable is near, or the result would be disastrous.

result would be disastrous.

Glaze for Light Oak Graining.—For making 1 pt. of glaze for darkening light oak graining, mix together 2 oz. blue black and 1 oz. burnt Turkey umber ground in water. Thin down to form a wash with equal parts of stale beer and water; apply with a hog-hair overgrainer and soften or tone down with a badger-hair softener. Allow sufficient time to dry and then apply one or two coats of hard oak varnish. Two coats of glaze may be necessary, according to the depth of colour required.

Lathe Chucks for Pipe- and Stick-makers.—Figs. 1 and 3 in the accompanying drawings show, one-third full size, two common pipe chucks made in beech. The block is first turned approximately to the outline shown in Fig. 1; the pin is then screwed to fit the lathe

the teeth at angles of 60° and 120° respectively. The chief work of the tenon saw is to cut the shoulders of the tenon (across the grain), therefore the sharpening is much the same as in the hand saw, the transverse bevel being a little less acute. The work of the mitre saw is to cut obliquely to the grain of the wood. The fronts of these teeth, therefore, should recline about 5°, and the file should be so held as to give a transverse bevel of from 10° to 15°, which will be at angles of about 75° and 105° respectively. The teeth of the panel saw should be sharpened much the same as the teeth of the mitre saw, as the panel saw is used for both ripping and cross-cutting. Tenons are cut in with this saw, after which the tenon saw cuts down the shoulder of the tenon. When setting saw teeth, care should be taken to get the set uniform; an equal amount of set must also be given to the teeth on each side or range. A properly ground ripping saw requires but little set. As hand saws vary in thickness, etc., the amount of set in each case cannot be definitely given. The hand cross-cut saw requires more set than the rip saw. The amount of set depends on the nature of the timber to be sawn, the thickness of the saw hlade, how it is ground, etc. A saw thinner at the point than at the heel and thicker on the tooth edge than on the back edge will require less set than a saw of the same gauge throughout the blade, and a thin saw will require less set than a thick saw. The blade of the



mandril, which is generally of brass with an internal thread. The chuck is then re-turned and bored out to the size required, plus the thickness of two pieces of rubber or cork, which are shown at A (Fig. 2) and B (Fig. 3), and which grip the job. The opening C (Fig. 1) is then cut out, thus dividing the chuck into two parts, connected together at the base, but each capable of a small amount of spring at the point. To fasten any object in the chuck the iron ring D (Figs. 1 and 2) is tapped up farther on the sloping part E. The chuck shown by Fig. 3 is made in the same manner, and is intended for bowls of pipes and larger objects than can be inserted in Fig. 1. It is closed by the nut and bolt, and Fig. 4 shows its end. The peculiarly shaped chuck shown in Fig. 5 is made in iron, and though sometimes found useful by a pipe-maker is more properly a stick-maker's and mounter's requisite. The inside is cored out to one or the other of the dotted lines and the stick is held by the two wedges (Fig. 6), of which there should be several sizes. These wedges are slipped in the front of the tool; see Fig. 5.

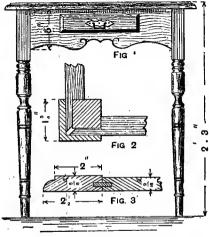
Setting Saw Teeth.—Below are instructions on setting the teeth of rip, hand cross cut, tenon, mitre, and panel saws. The teeth in a rip saw should be so filed that their fronts will be perfectly upright. A transverse bevel of from 3 to 5 should be given to the faces of the teeth. To give a bevel of 5 the file should be held at angles of 85 and 95 respectively. The work of the hand cross-cut saw is to cut across the fibres of the timber, therefore the cutting edge must be keener than for the rip saw; otherwise the teeth will compress the fibres, so that difficulty will be experienced in making a cut. The fronts of the teeth in this saw should recline about 10, and the file should be shot across the faces of

tenon saw being thin, and the cuts made with it not very deep, much less set is required in this saw than in the hand cross-cut saw. Very little set is required in the mitre saw; in fact, if the teeth are kept fairly sharp, the set required will be scarcely perceptible. The set given to panel-saw teeth should be a medium between that of the rip-saw teeth and the teeth in a properly ground hand cross-cut saw. Excessive set in each case should be avoided, as a saw will do its work better and more easily with only just enough set to free the blade. Set the teeth in each case with a small hammer.

Petroleum Furnaces.—There are two ways of burning petroleum for heating furnaces. In one, petroleum is supplied from a tank connected to the jet in front of the furnace by a small pipe; in the mouth of the furnace is a jet or atomiser, shaped somewhat like the tuyère of a blast furnace, through which a blast of air is blown in sufficient force to raise the petroleum into the jet, from whence it is immediately blown into the furnace by the blast. The furnace is first brought to a bright red heat by a fire, and the petroleum is them blown in as above described; it is immediately and perfectly burnt, producing an intense heat. In the other method the petroleum is placed in a tank above the furnace, and falls by gravity through a small pipe on to a large fireclay slab at the mouth of the furnace. The furnace is in this case also first brought to a red heat, and the petroleum is allowed to drip as fast as necessary from the pipe on to the red-hot tile. The sizes of pipes, etc., for the furnaces would have to be worked out by a person specially experienced in this class of work, or else found out by trial. No method which involves raising the whole of the oil to a boiling temperature is practicable on a large scale owing to the risk of explosion.

Black for Bolts and Nuts.—For a black for bolts and nuts thoroughly mix together one part of bismuth chloride, two parts of mercury bichloride, one part of copper chloride, six parts of hydrochloric acid, five parts of alcohol, and fifty parts of water. The articles to blacked must be first freed from grease; this is best done by boiling them in a solution of cauetic soda and drying in sawdust. When clean, dip them in the above solution and allow to dry, then place them in boiling water and boil for half an hour. If the articles are not then black enough, re-dip and re-boil. When they are of the correct colour, place them in a bath of boiling oil for a few moments, then heat them till the oil is driven off. An alternative method, and one that is frequently used for holts, etc., is as follows. Dip the articles in oil, preferably linseed, and heat till the oil is burned off. The surface produced is coal black in colour, and will withstand almost any heat.

Card Table.—A card table 3ft. square is much too large; 2ft. square will be quite sufficient. Fig. 1 shows a design in elevation of a card table of the size last mentioned. The table should be made of hardwood; if pine or whitewood is used, increase the thickness of the members about in. Fig. 2 shows the method of joining the rails to the general statements. The framework is 1ft. 8in.



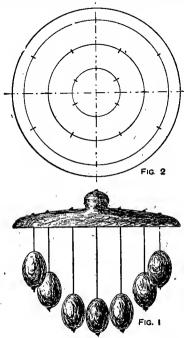
Card Table.

square, which will allow the top an overlap of 2in. all round. The drawer has a bevelled front which acts as a stop, and may be 10in. long by 5in. wide. Two methods can be adopted for making the top. The margin can be framed level with the centre with a suitable moulding worked on the solid or stuck on, the baize or leather centre can be laid, and the margin levelled with sawn veneer; or the centre can be left thin lower on the top side, which will be filled up with the baize (see Fig. 3). In laying the cloth or leather, use equal parts of glue and flour paste; allow it to get nearly cold before using, and spread it on with a palette knife, sleeking out with a piece of smooth round-edged wood or a rubber roller equeegee. Kuife the edges with a very sbarp thin knife.

white Enamel Paints.—For enamel paints, use genuine zinc white and varnish; for outside work the palest and most durable varnishes, as French oll, carriage, maple, dial, and pale copal varnishes, pale gold size and turpentine being used as drying agents, whilst the enamels for interior decoration, not being subjected to the same atmospheric influences, may be prepared from mixtures of lees expensive varnishes, as dammar or crystal paper varnish hardened with a little copal or French oil varnish. To prepare a durable euamel for outside useprocure lolb. of genuine zinc white in varnish, which must be ground exceedingly fine, 7 pt. of pale copal varnish, 1pt. of pale japan gold size, and ½pt. of American turpentine. Break up the zinc white and mix to a uniform consistency with a copal varnish, then add the gold size, and finally thin down with the turpentine, when it will be ready for use. Enamel for interior decoration may be prepared by mixing together as above 101b. of zinc white ground in varnish, 4pt. of dammar or crystal paper varnish, 3 pt. of French oil varnish, 1 pt. of pale gold size, and ½pt. of American turpentine. In each

case, should the enamel become thick, thin down with more turpentine. To prepare white enamel successfully always procure the palest and most durable varnishes. When applying enamel the undercoats should be perfectly solid and free from inequalities, otherwise the resulting work will appear irregular and patchy. The best methode of preparing the undercoats is to apply two coats of zinc white or white-lead ground in turpentine, adding a little oil to bind it, and flatting down each coat until a solid foundation is obtained, which will give the enamelled work a pure white appearance when finished.

Indian Rattle.—The following describes how to make an Indian rattle for amusing a baby. Hindoo mothers hang one up for their child to kick at, and when the rattle is chaken, the egg-shaped balls bob about and the noise is like the clucking of a hen to her chicks. A piece of hard wood 1½ in. thick is turned to a shape like that of the cover of an old-fachioned earthenware jar and 7 in. in



Indian Rattle.

diameter: see Fig. 1. Take the wood off the lathe, and on the flat side mark circles with radii of lin., 2in., and 3in. respectively. Then step round these circles with their own radii, marking them off as shown in Fig. 2. Now turn up nineteen egg-shaped pieces about lin. by lin., and hore holes through their lengths for elastic cords. Take one egg, thread it on and knot the elastic, and cut off 6in. of it, putting it through the centre of the disc and fastening. Cut six lengths of 5in., threadle the eggs, and put them on the small circle, and proceed similarly with the next six eggs, making the elastic for those fin. long, another six being kept 3in. long. When in position the eggs form a sort of inverted cone. A cord is fasteued to the top, and the whole is suspended over the cot so that the baby can kick it. The addition of a toy bell to each cord would make it more musical, but would not be estrictly Indian in character. Rattles made in India are generally paiuted in brilliant colours such as vermilion, with yellow lines on the eggs.

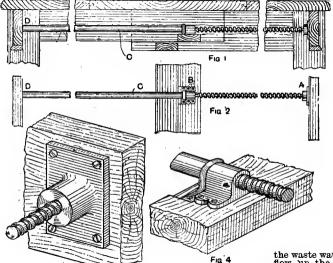
Welding Channel Tyres.—To weld channel tyres properly a special forge is required. Such a forge is described and illustrated on p. 169, Series II. Of course, for different shaped channels, top and bottom tools to match would be necessary. In the absence of such a forge it is possible to use an ordinary forge by simply flattening out the ends of the tyre bar and then welding up in the usual way, working the flanges back to shape again by using top and bottom tools as described in the reply referred to above. For welding, flux is not necessary, a clean fire and some sharp white sand being found sufficient.

Heating Value of Range Boilers.—The effectiveness of range boilers in heating water depends upon the area and disposition of the heating surface. For a given position in relation to the fire the greater area has the greater general effectiveness, while the surface nearest to the incandescent fuel has greater effectiveness than the surface farther removed. A block boiler having say 14sq. ft. of heating surface would have ahout if the intensity of the back. The relative effectiveness of these surfaces is about 10, 6, and 4; in other words, the front surface against the incandescent fuel is of double effectiveness to the average of the remainder. The surface of the tubular boiler is wholly of this best kind, and every foot of surface of the boiler is one-and-a-half times as effectiveness of a boiler therefore depends on the surface. If a block boiler could be provided with about double the heating surface possessed by a tubular boiler (which, however, is unlikely), the block boiler would be the more effective of the two. But the tubular boiler has in the boot boiler a more powerful competitor than the boot boiler.

Screw Attachment for Extending Dining Table.— The accompanying illustrations show a screw attachment used for extending dining-room tables. Fig. 1 shows a part sectional view through the table and elevation of the screw arrangement; Fig. 2 is a plan. One end of the screw works in a collar as shown at A work no mischief. Heated air (heated by stoves, not how water) is not used to any great extent. This mode of heating is moderately cheap, but many people do not like the hot air because of its occasional dryness. This largely depends on how the apparatus is erected and afterwards used. Air that is warmed by passing over heated irou is rendered disagreeably dry (1) if the iron attains a high temperature, and (2) if water pans to furnish the air with molsture are not provided. But when the apparatus is properly attended to, and the bad conditions referred to above are prevented, this mode of heating is not to be condemned. Perhaps the greatest drawback to heated air is the trouble caused by surveyors and fire-insurance agents, who do not look kindly on this mode of heating. Heated air does not possess advantages over hot water or steam as a heating agent.

Cleaning Copper Urn.—Rub the urn with a mixture of fine ground crocus powder and best sweet oil; use a brush for the ornamental portions. Polish off with a dolly used on a lathe and dry crocus powder.

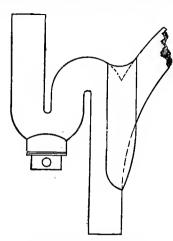
Ventilation Pipe on Sink Trap.—The accompanying illustration shows the proper position of the ventilating pipe on a lead syphon trap under a sink, and also the manner of making the joint. Many men, whenever possible, fix the vent pipe on the crown of the trap. But this plan is very objectionable, because in a few weeks the pipe becomes choked. As shown in the illustration,



Screw Attachment for Extending Dining Table.

(Fig. 2), through which the screw projects, having a square end so that the handle can fit on it. At the other end of the screw is shown the box through which it works (see B, Fig. 2); C (Figs. 1 and 2) is the harrel, one end being attached to B; the other end D is sometimes let into the rail of the table as indicated. Enlarged conventional views of A and B are given at Figs. 3 and 4. The end D (Figs. 1 and 2) is let into the end rail. These screws can be obtained from any cabinet ironmonger.

Heating Building by Steam, Hot Air, or Hot Water.—Private residences are preferably heated by hot water, and even for huge business places, stores, buildings and the like, hot water is largely used, the fires being kept going night and day so that frost is defied. A hotwater apparatus is more easily regulated than any other, and the temperature of the rooms can be raised or lowered as desired. But hot-water work, when properly done, is the most expensive plaut to instal, although the most economical in the end. Steam, on the other hand, is always at one temperature (in this work) and is objectionable to this extent, that for half the cold season, full heat is undesirable and unnecessary, and the consumption of fuel is greater than the weather requires. But steam plant is moderately cheap to erect, and compared with water is very quick in heating up. This is an advantage in places where the fire is not kept alight continuously; and, of course, steam pipes being empty of water when cold, frost can



Ventilation Pipe on Sink Trap.

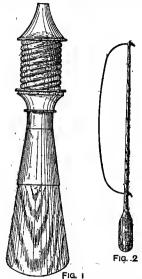
the waste water passes the end of the pipe but cannot flow up the pipe. Further, whichever way the air currents are passing (which is upwards when no water is flowing through the waste pipe, and downwards when the sink is being emptied) no sharp turns exist to retard the velocity of the flow of air.

Determining Lifting Power of Balloon.—The weight that the balloon will carry may be determined by experiment. Fill a small balloon with hydrogen gas, attach a light car to the balloon, and pour shot into the car until the balloon will only just rise from the ground. Weigh the balloon and car when empty, together with the shot, or the shot alone if only the neeful weight that the balloon will lift is required.

Imitation Mother-of-Pearl for Cycle Frames.—
One method of producing imitation mother-of-pearl embellishments ou cycles that are to have a stove enamel fluish is as follows. The frame is given a coat of priming, stoved, and flatted down. The second coat is white; this is also stoved and flatted down. The hlue and green tints are put on side by side, and drawn out with a dry camel-hair brush, leaving spaces of white, and again stoved. Cut up with black enamel into irregular squares, diamonds, dots, etc., and stove. Another method is to procure some scrap mother-of-pearl from a pearl button factory. Give the frame a thick coat of enamel, stick the pearl scrap, which must be very small, on the enamel in any suitable shapes, and stove. Continue to coat and stove until the pearl is level with the surface of the enamel. Give a coat of finishing enamel, flat down, and polish with dry rottenstone.

Rendering Gelatine Tough and Elastic.—To render gelatine tough and elastic, mix with ita material that will hold a certain portion of water, so that the gelatine does not become dry. Perhaps the best materials for this purpose are glycerine and treacle. The proportions to he used will have to be found by experiment, but the quantities given below will serve as guides. Take 11b. of glue or gelatine, add just sufficient water to cover it, allow to stand overnight, then melt down by a gentle heat and stir in \$1b\$. of glycerine, or 11b. of glue treated as above and \$1b\$. of treacle. In using these mixtures there is a drawback, from the fact that in a damp place they absorb moisture, and become sticky; to obviate this, add \$10c\$. of bichromate of potash. The bichromate of potash, under the influence of light, renders gelatine insoluble.

Inserting Wrest-pins and Hitch-pins in Piano.—When inserting pins in a piano, it is, of course, necessary that all the holes of a series should be bored at a certain angle; the holes in the wrest-plank are bored in such a way that the pins will incline slightly upwards, the holes in the bent side and bottom plate for hitch-pins incline downwards, and the holes for bridge-pins are bored at an angle that will best resist sideway strain. A carpenter's ordinary brace stock will be found very inconvenient for making the end holes. A drill stock

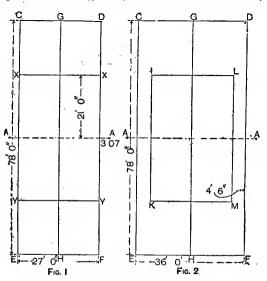


Drill Stock and Bow for Pianoforte Makers.

and drill bow (see Figs. I and 2) will be a much more convenient tool and less tiring to the worker; the whole series represents nearly one thousand holes. The holes for the wrest-pins are made with a good quality quill bit; its size must correspond with the pins that will be used. As the sizes of the pins vary, it is advisable to experiment on a spare hit of beech before boring the holes; all should be a true fit, and fairly tight. The quill hit should fit direct into the stock, and, to ensure the holes being bored of a uniform depth, the hit should be run through a piece of 1-in. dowel rod endwise, one end to butt against the stock, and the other end being cut so as to leave sufficient of the hit free for boring to the required depth. To enable drills to be used in the same stock it is furnished with extra iron padsor chucks; one end fits into the stock similarly to the hits; these are secured by a set-screw. The drill bow is of lance wood 2 ft. 9 in. long, in wide at one end, \$in. at the tip, and \$in.\$ thick; 6 in. of the wider end has an extra thickness planted on each side, and is them shaped into handle form. At \$in.\$ from the handle and tip, holes are bored through which to pass a length of gut as used on violoncellos; the ends of the gut are secured by tying into knots. The gut should be sufficiently long to enable it to be passed round the grooved part of the stock once and bend the bow sufficient to give clearance as it is worked to and fro. Drill bows can be bought made of iron, and are extremely useful for the smaller holes, but are apt to strain the wrist if used for the larger holes. Holes for the insertion of screws or bolts in wrest-planks are bored by

a carpenter's ordinary long twist bit. For screws, two bits of different size should be used, the larger hit to bore the hole half the dopth, the other bit not quite the depth of the screw; this will enable the screw to gain a firmer grip. The holes should be countersunk to allow the screw heads to fit in level with the face of the planks, unless mushroom-head screws are used with brass collars; in this case, countersunk holes are not required; the screws are turned home with a screwdriver bit fitted into a brace stock. If bolts are used, the holes are bored right through: in either case, care should be taken that the screws or bolts are so placed that they pass through or grip into the bracings. or grip into the bracings.

Setting out Tennis Court.—A tennis court for the single-handed game (one player against one) is shown in Fig. 1: whilst a tennis court for the three- or four-handed game is shown in Fig. 2. For the single-handed game the court is 27ft, wide and 78ft. long, and is divided across the middle by a net, the ends of which are attached to the tops of posts AA (see Fig. 1), which stand 3ft. outside the court on each side; the height of the net is 3ft. 6in. at the posts and 3ft, at the centre. At each end of the court, parallel to the net, and at a distance of 39ft. from it, are drawn the base lines OB EF, the extremities of which are connected by the side lines CE and DF. Half way between the side lines, and parallel to them, is drawn the half-court line GH,



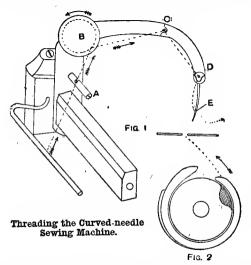
Setting Out Tennis Court.

dividing the space on each side of the net into two equal parts called the right- and left-hand courts. On each side of the net, at a distance of 21 ft. from it and parallel to it, are drawn the service lines X X Y Y. In the three- or four-handed game the court is 36 ft. in width. Within the side lines, at a distance of 4 ft. from them and parallel to them, are drawn the service lines I K and L M. The service lines are not drawn beyond the points I, L, K, and M towards the side lines. In other respects the court is similar to that for the single-handed game as illustrated by Fig. 1.

Position of Load Water-line in Boats, etc.—In boats the load water-line is not usually taken into account. In yachts and launches it is usually the line about which the profile is designed; then when the designer has determined roughly the weights of hull, stores, machinery, etc. etc., he decides on the amount of displacement that will be required. Experience teaches what lines upon given dimensions will give the bestresults. In a cargo ship its precisely the same, only the quantity of cargo required has to be taken into account as well as the other weights. With an existing craft aground, to determine the probable load-line the calculations are somewhat complex; the shape of the craft has to be taken off, the displacement worked out to an has to be taken off, the displacement worked out to an approximate line, and the weight determined either by calculation or on the balance priuciple; then, as the displacement must agree with the weight of the craft and her equipment, so the approximate loadline is shifted until the displacement and weights coincide.

Removing Oil Stains from Book Cover.—It is considered rather a hopeless task to attempt to remove oil stains from a book cover, though the following method may be tried. Make up a pad of a few pieces of good blotting-paper. Lay this over the stain, and press on it a hot flat iron. Continue this treatment for some time, occasionally lifting the blotting-paper to examine the spot. Care must be taken that the heat from the iron does not injure the cover. Now make a small pad of cotton-wool, well soak it with benzine (procured from a chemist), and with this wash the entire cover, taking care not to rub or to apply the benzine in patches. Let the washing be done with broad, swift strokes from side to side of the cover, and from top to bottom. When washed, allow to dry thoroughly. When the benzine is applied, the cover will probably look black, or very much darker than it was originally, but this will pass away, and with it possibly the oil stain. When using benzine, keep it well away from artificial light or fire, as it is highly infiammable. Use it in a cool room in davlight. After the cover has become dry, it can be washed again and again.

Threading Curved-needle Sewing Machine.—Fig. 1 represents the moving arm of a curved-needle sewing machine. Place a reel of cotton (No. 40) on the spool wire at the rear of the machine, draw the cotton into the thread check A, around the tension pulley B in the direction indicated by the arrow, thence through the eyelet C to the hole D, and through the needle eye E

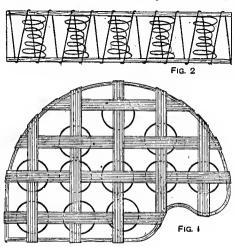


from left to right. Fig. 2 shows the threading of the under cotton. Place a bobbin on the long winder spindle, and wind the bobbin fairly full of No. 40 or No. 50 cotton; then remove the ring slide, and place the bobbin into the cavity of the hook, allowing the cotton to draw from the rear toward the front, as indicated by the arrow. Bring up the ring slide as close as the stopscrew will allow, and tighten the set-screw. To begin sewing, raise the presser foot and place the goods to be stitched on the cloth-plate, drop the presser foot, hold the upper and lower threads in the right hand, and commence to sew by turning the cam wheel from the machinist.

Thermometer.—To make a thermometer, some knowledge of glass-blowing is needed. Presuming that the tube
has been obtained, the following is the method adopted
for excluding the air, filling with mercury, and sealing
the end. The common mercurial thermometer consists
of a glass tube of uniform bore, terminating in a hollow
bulb. By holding the bulb over the flame of a spirit
lamp, a considerable portion of air is expelled from the
bulb and tube; and the open end of the tube being
immersed in a cup of mercury, as the air within the
tube 'and bulb condenses, the external stmospheric
pressure drives a portion of mercury in to fill the space.
A paper funnel is next tied round the open end of the
tube and filled with mercury. Then the mercury already
in the bulb is boiled over a spirit lamp, with the result
that the whole of the air remaining in the tube is soon
expelled and its place taken by mercurial vapour. The
instrument being again allowed to cool, thes mercurial
vapour is presently condensed, and its place supplied by
mercury driven down the funnel. The process is

continued till both bulb and tube are completely filled with mercury. Lastly, when the mercury has cooled down nearly to the highest temperature intended to be measured by the instrument, the end of the tube, hitherto open, must be perfectly sealed by means of the blowpipe. As the mercury afterwards continues to cool, it will be considerably condensed, and, sinking down, will leave a vacuum in the upper part of the tube. The thermometer has now to be graduated, and for this purpose it must first be immersed in melted snow. When the mercury has cunk as low as it will go, a graduation must be marked opposite the extremity of the mercurial column for the freezing point. The thermometer is next immersed in the vapour of water, boiling under a given atmospheric pressure. When the mercury is again stationary another graduation must be marked opposite the extremity of the mercurial column for the boiling point. The distance between these two graduations is then divided into a number of equal parts, and divisions of the same extent are marked in both directions to the extremities of the tube. The instrument will then be completely graduated, and may be mounted in any way desired.

Spring Cushion.—To make a spring cushion, bend some \(\frac{1}{2}\)-in. round iron to the shape as shown Fig. 1; either lap the joints one over the other to preserve the correct outline, or have them welded. If desired, \(\frac{1}{2}\)-in. cane can be used instead of the iron, but it is more difficult to work to the correct sweep. Two frames, one



Spring Cushion,

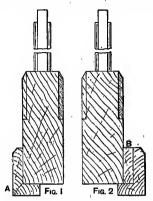
each for top and bottom, will be required; cross-web these with good grey webbing, which must be lapped over the iron or cane, and sewn fast. Sew the springs to the webbing by the top and bottom coils. Press the two frames down until the springs are compressed about one-third their length; then lash the two frames together all round the edges with laid cord (see Fig. 2). Cover the top and borders with hessian, and stuff up on this. The covers will require welting and piping at the front at least, and any tufting can be tied up before the bottom is underlined with black Forfar, which is turned in at the edges and stitched fast. If the cushion is stuffed all round the borders, make the frames about 1 in smaller than the finished size. For plain borders and stuffed front, net measurements will have to be taken; the slight swell at the front will be an advantage.

Purifying Bed Feathers.—Baking is only possible for chicken and turkey feathers. The feathers of all aquatic birds require other and more delicate treatment to get rid of the greasy impurities, and if used after merely baking may give off an unpleasant odour later. In the absence of proper purifying and teasing machinery the following method can be adopted. Make up a bath of 12 gal. of cold water, and in this dissolve 2 lb. of alum, 2lb. of cream of turtar, and ilb. of washing soda. Place the feathers in this and allow to stand for three days, then wash them in clean water. Now make a bath of 30z. of chloride of lime and cold water. Place the feathers in this for a few hours, then rinse in clean water and dry on a wire grid. It would be an advantage to run the feathers through a willowing machine before again making them up.

Detecting Carbonic Acid in Atmosphere of Room.—A method by which the presence of carbonic acid gas in a room can be detected is the following. Fill a large wide-mouthed bottle (a pickle bottle for instance answers very well) with water, and carry the bottle of water into the room the air of which is to be examined. Invert the bottle so that the water may run out into a basin or bucket, and the bottle will then be filled with the air of the room. Now pour into the bottle a little clear lime water, shake vigorously, and the lime-water will become turbid owing to the formation of carbonate of lime. A saucer filled with lime-water placed in the room would, in a short time, become covered with a pellicle of carbonate of lime. These results would be obtained with air taken from any situation, because carbonic acid is a normal constituent of the atmosphere, being present to the extent of 4 parts in 10,000; only when carbonic acid is present in excess does air become vitiated. In living rooms the carbonic acid may increase to 6 or even 8 parts per 10,000, but the rooms then feel stuffy. The comparison between a pure air and a vitiated air is found by a quantitative determination of the carbonic acid.

Converting Rebate Plane to Side Fillieter Plane.

To convert an ordinary 14-in. rebate plane into a side fillister plane to make rebates of any width, all that is necessary is to box out a fence of hard wood, preferably birch, and screw it ou the plane as shown at A (Fig. 1). If a left-hand plane is required, screw it on the other side as shown in Fig. 2, and to alter the



Converting Rebate Plane to Side Fillister Plane.

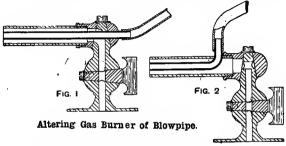
width of the rebate insert a strip of birch of the necessary width between the fence and the plane as shown at B.

Chippendale Furniture.—The name "Chippendale" is derived from Thomas Chippendale, a London cabinet-maker and wood carver, who in 1764 published designs for furniture. He professed to draw his inspiration from the then prevalent French fashion, but shows a greater tendency to follow architectural lines. The material used by him was almost invariably mahogany. The characteristics of this furniture are sound workmanship, elegance, and delicate carving. Perhaps mahogany chair backs, somewhat architectural in design, are the most typical Chippendale ordinarily to be met with. The strapwork mahogany chair backs, so frequently confounded with Chippendale, are rather to be attributed to the influence of Heppelwhite, whose designs for furniture were not published till 1789.

Resetting Wrest-plank of Piano.—Wrest-planks inserted in pianos are glued and tightly cramped into proper position before screws or bolts are put in. If both glueings and screws give way owing to the excessive strain of the wires, before the plank will return to its former position this strain must be released by slacking out the wires, and it is doubtful whether a really sound job will result from merely inserting bolts in place of the screws. The correct plan of procedure would be to slack out the wires and remove the top capping (a thin board glued on top of the plank); this will be destroyed by removal, and must afterwards be replaced. The defective joint thus exposed to view should be freed from old glue, chips, and shavings, and two wedges should next be driven in to open the joint at the whole length of the instrument, two narrow slips of wood should be fixed by fine brade, to form a channel.

Hot glue is run into the channel, and is then worked well into the joint by means of a table knife with a long thin blade, which has been warmed by dipping into hot water. A powerful cramp should be fixed at the middle of the plank, a block of wood being put against the face of the plank first. The wedges being removed, the cramp is tightened up, two extra wedges being placed ou each side. All the wedges are tightened up, fetching out thereby as much glue as possible. Allow the piece to stand in the cramps at least twenty-four hours, and as these are removed, hore holes right through where the screws were formerly inserted, and put bolts through in their places with washers under the nuts. The slips forming the glue channel may now be removed, the surface levelled and freed from glue, and a new capping put on. The instrument will require to be tuned several times before the wires will settle to their normal position; at least three days should be allowed for the glue to harden before tuning is attempted.

Altering Gas Burner of Blowpipe.—If only a small blowpipe jet is required the supply of gas might be much restricted by reducing the size of the swivelling pipe of the blowpipe to about one-half its present diameter. If, however, a good sized blowpipe flame is required, the better plan would be to tighten up the screw on top of the swing joint so that it could not move, and to drill a hole right through it from the back, and this could be tapped. A smaller pipe screwed one end could be inserted from the free end of the larger pipe and screwed into the tapped hole; the two concentric pipes should then be cut off to the same length (see Fig. 1). Care must be taken that the gas can get to the outside of the inner pipe. A rubber tube affixed to the back end of the inner pipe can be used to blow



through, when an excellent flame will be obtained. If the fitting is preferred to swivel as at present a pipe could be inserted as shown in Fig. 2, and this would have the same effect. It should be remembered that gas requires for its complete combustion five and a half times its volume of air, and in ordinary Bunsen or atmospheric burners the quantity of air supplied through the side holes should be 23 times the volume of the gas, the remaining 32 volumes being supplied by the air around the flame. In the blowpipe nearly the whole 55 volumes of air are supplied by the blowing.

Incense.—The ingredients for inceuse vary with the makers, but the following may be taken as examples.

(a) Powdered sandal wood 41h., powdered cascarilla park 21b., gum benzoin 21h., vitivert \(\frac{1}{2}\)b., nitre \(\frac{1}{2}\)b., and musk 1 gr. Mix the ingredients thoroughly. (b) Wood charcoal 21h., gum benzoin \(\frac{1}{2}\)b., vanilla, tolu balsam, and cloves \(\frac{1}{2}\) ib. of each, sandal wood oil \(\frac{1}{2}\)oz., neroli oil \(\frac{1}{2}\)oz., and nitre 3 oz. Powder the solid ingredients and mix well.

Effect of Temperature on Length of Tie.rod.—
The range of temperature in England hetween the
extremes of summer and winter may be looked upon
as causing a variation of \(\frac{1}{2} \) in, per 100 ft. in the length of
an exposed irou rod, bar, or girder. Therefore a tie-rod
40 ft. long hidden in the floors of the interior of a building would vary considerably less than two-tenths of an
inch, probably not more than one-tenth, and if tightened up in the summer the tendency to contract in
the winter would be taken up by a slightly increased
tensile stress in the rod, so that no movement of the
walls need take place. In the case of a flank wall,
where tie-rods cannot be carried through the opposite
party wall, the rods may sometimes be carried
diagonally to front and back wall respectively, near
the junction with the party wall. The end of a tie-rod
should be jumped-up by the smith so that a larger
thread may be put on, a 1-in. rod with a 14-in. screwed
end will be increased in strength 40 per cent. over a 1-in
rod with a 1-in. screwed end, because the full diameter
of the rod will be utilised.

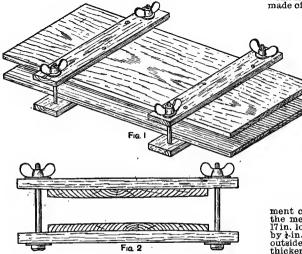
Mixing Beeswax with Liquid Starch.—Perhaps the best way of incorporating beeswax alone with liquid starch is to prepare a very stiff pasts by mixing 1 part of dry starch with 5 parts of water and boiling while stirring. The beeswax should be meited in a separate pan and poured very slowly into the paste while it is being stirred vigorously. The stirring should be continued until the mass is nearly cold in order to prevent the beeswax separating in lumps and keep it as an emulsion in the starch. The starch may afterwards be mixed with warm water, but the temperature should not be allowed to rise above 140° F. or the beeswax will melt and come to the surface. An emulsion of beeswax could be made by using pearlash, but this might possibly injure the size. Beeswax is not easy to incorporate in this way, hence japan wax and paratin are used.

Arousers Press.—The drawings show a treusers press 2ft. 6in. long by 1 ft. wide, When tightening up some of these presses, more pressure is sometimes brought to bear on the cutside than on the inside; this can be obviated by tapering the ledges towards each end, thus leaving them thicker in the middle and curved on their side next to the board, as shown at Fig. 2. For making the press, hardwood is to be preferred, but pine may be used for the boards, and mahogany, beech, cak, or any

up the flatting (white-lead broken up in turpentine) with a little oil to bind it and keep it open for working. The flatting should be either a little lighter or deeper than the oil ground, for as the flatting when wet has the same gloss as the colour on the ceiling, it is difficult to see whether the work is all covered. The edges of the flatting must not be allowed to set, or the ceiling will look streaky and glossy in places. As the colour is put on it must be stippled over with a dry brush or a stippler, to get the surface uniform. Work with the scaffold across the light and not in the direction of the light entering the room.

Carbolic Floor Varnish.—The following is a simple sanitary floor varnish and stain combined. Dissolve 21b. of crange shellac and 31b. of gum sandarach in 1gal. of methylated spirit by agitating at intervals, afterwards well stirring into it a few drops of carbolic acid. This varnish may be applied colourless, or coloured by adding, in variable proportions, vandyks brown and oak stain for light and dark oak, walnut, etc. For mahogany, add bismarck brown. Other colours may be prepared by adding aniline dyes, soluble in spirit. Apply the varnish quickly and evenly, two coats being necessary. It dries hard, with an excellent gloss, in a few minutes, and is an excellent disinfectant.

Making Square Iron Boxes.—For a box, which is made of 2-in, by \(\frac{1}{2}\)-in, section iron to an inside measure-

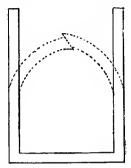


Trousers Press.

similar hardwood for the ledges. The boards should be in thick, and the ledges in in the middle, tapering to in at each end, and about 3 in wide. It will be advisable to screw the boards and ledges together. For the tightening arrangement, bolts about 4 in. long by in togin in diameter, with wing nuts, should be used, a good plan being to have washers next to the head of the bolts and under the nuts. To prevent the washers under the nuts becoming lost, they should be countersunk and secured by a couple of screws to the ledge.

Petroleum Jelly.—To make petroleum jelly meltl part of paraffin wax in a pan, and stir in 5 parts of a heavy mineral lubricating oil. Stirring should be continued till the mass is nearly cold. Ordinary petroleum jelly is made from yellow wax and oil, but a white kind may be obtained from white wax and a very pale-coloured oil.

Painting Ceiling in Flatted Oil.—For painting a distempered and cracked ceiling in flatted oil, first wash off the old distemper, and remove and make good any loose parts. Repair the cracks with plaster or Keene's cement, and cover the ceiling with lining paper, care being taken to make the paper good at the joints without lapping, or the edges will show. The ceiling should be sized previous to putting on the paper, which, when up, should also be sized. When thoroughly dry give two coats of paint mixed with a little more oil in it than turpentine (such as is used for priming new wood), which should be tinted to the tone that it is intended to finish the ceiling. For the second coat a little more turpentine might be added to the paint. If after the second coat the ceiling looks patchy—that is, dead in some places and glossy in others—apply a third coat of paint. When the colour is dry, but not too hard, mix



Making Square Iron Boxes.

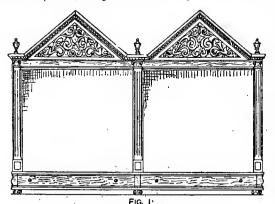
ment of 4 in square, take an 18\frac{1}{2}-in. length of iron; it the measure is 4 in square outside, cut off the plate 17 in. long. For a box 5\frac{1}{2} in square inside, made of 3 in. by \frac{1}{2}-in stuff, cut off the iron 2 \frac{1}{2} in long; if 5\frac{1}{2} in square outside, cut off 23 in. When making the boxes, first thicken the ends by jumping up, then form the two bottom corners as in the illustration, scarf the ends, bend them over, as shown by dotted lines, and weld up on the beak iron; then form the other corners by working up on a mandril of the size of the inside measurement.

Painting on Keene's Cement.—Keene's coment should not be left more than twenty-four hours before being painted, though twelve hours is better. Either water from the atmosphere condenses on the surface of the cement, or water from the atmosphere is absorbed by the surface layer of the cement, or water comes to the surface from the inner layers of material, with the result that the paint runs.

Covering Draught Screen.—Flax sheeting for covering a draught screen should be thoroughly wetted with a draught screen should be thoroughly wetted with the cold water and stretched tight and even on the frames. Always commence tacking in the centre and work to the corners, the tacks being afterwards hidden with a coloured gimp or leather banding with brass studs. The sheeting could be primed and painted in cils or distemper, or applique ornaments of compressed pulp, carton-pierre, or gesso work, could be glued on and afterwards gilded or coloured. Flax sheeting can be purchased 31 in., 36 in., and 54 in. wids. American leather is also a good material for covering screens, being washable and durable, but it should be warmed before a fire before laying to prevent cracking. It allows the leather to expand a little, and the subsequent contraction on cooling makes a tight job. Japanese leather paper, Lincrusta Walton, printed satsens, silks, etc., are all suitable screen coverings. No advantage would be gained by using three-ply wood panels, except in the very thinnest stuff. The panels would look well if fretted and backed with soft fabric. In order to make the frame harmonise with the panels the stiles should be decarated with chamíers or beaded, with a fretted pediment to match and turned finials.

Bleaching Horsehair.—If white horsehair is required, the whitest obtainable should be chosen and bleached. First it should be thoroughly washed in hot soap and water, then passed through hot clean water and allowed to soak overnight in a bath of hydrogen peroxide rendered alkaline by ammonia; it should then be again put through clean water and slowly dried. Yellow and grey hair may be bleached in the same way, but they will not give a dead white.

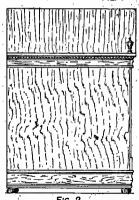
Breeding Cage for Canaries.—Figs. 1 and 2 are front and side elevations respectively of a double breeding cage 3ft. long and 1 ft. 8 in. high. The wirework fronts are omitted, as it is preferable to buy these ready made. The cage is divided in the centre by a partition that may be made to slide in from the back. Mahogany, walnut, or oak may be used for the woodwork forming the front and outer portions of the cage. Fig. 3 shows

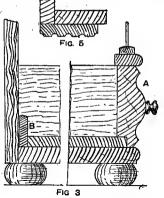


seams should be caulked with cotton or oakum and well coated with pitch; the sides should be similarly treated for about 3 in. up. A piece of wood, about 1½ in. by 1 in., nailed along the centre line to form a keel will prevent the bottom planking getting chafed. Seats can be fitted.

Painting Interior of Vapour Bath.—Paint for the inside of a vapour bath should be non-poisonous and should dry extremely hard. First apply two coats made by mixing 3 lb. of zinc white ground in oil with equal quantities of turpentine and boiled oil, adding a little gold size as a drier. Allow the first coat to dry thoroughly before applying the second, then give a finishing coat made by mixing together 5 lb. of zinc white ground in turps with 2 pt. of the best carriage varnish and 1 pt. of japan gold size. Allow seven days for hardening before using the bath. The above preparation will dry hard with an enamel surface and remain unaffected by the steam. Zinc white is non-poisonous.

Lime Concrete Floor.—Assuming that the floor is to be laid on earth, the cinders should be riddled through an t-in mesh, throwing away all the fine dust that passes through the sieve. The lime should be blue lias lime, ground fine, and unslaked; the lime can be purchased in bagsfrom the makers, like Portland cement, and the most suitable lime is obtained from Barrow-one Soar, Rugby, and Lyme Regis. Pure or fat lime is unsuitable. Clean sharp sand, free from all earthy matter, will also be required. Prepare gauge boxes for measuring the materials, then on a wooden mixing-floor make a heap of four measures of cinders, one measure of sand, and one measure of lime. Turn the heap over twice with a spade to ensure a thorough mixing of the heap and add water from a rose, not from a bucket, turning the heap over from the edges into the middle. When the materials are all thoroughly wetted, but not sloppy, turn them over a second time and the concrete is ready for spreading. As the concrete is laid it should be well heaten down with a flat-faced punner. About 20 gal. of water will be required for each cubic yard of concrete.







Breeding Cage for Canaries.

an enlarged section through the drawer at the bottom of the cage. The front is moulded as at A, and the back of the drawer is shown at R. Fig. 4 is an enlarged detail of one of the pilasters, with a portion of the top moulding. The ovolo moulding, with the egg-and-tongue enrichment, may be bought ready prepared, either in pressed or machine carved wood. Fig. 5 gives a sectional plen through the pilaster. The pediments over the centre of both divisions of the cage may be filled in with fretwork, as shown in Fig. 1, or may be carved.

Building Small Punt.—Below are instructions on building a small punt in which cheapness, lightness, and very little draught are the three main requirements. For the sides, get two l-in. planks It. 4in. wide and 14ft. long; for the ends use 14-in. planks. Cut the sternpiece 2ft. 6in. long at the bottom and 3ft. 4in. at the top. Cut the how-piece 1ft. long at the bottom and 1ft. 8in. at the top, then cut a centre-piece 1 ft. wide, 3ft. 4in. long at the bottom, and 4ft. 2in. long at the bottom. This can be readily done by bringing the plauks into place with a rope across them twisted by a lever. After the sides are seamed, true up the bottom edges, and plank crosswise with \$\frac{1}{2}\$-in. planking, slightly beveiling the edges to allow for caulking the seams. The

Before starting the work wooden pegs may be driven into the ground to indicate the correct level of the floor. The surface should be finished with a fine skin of Portland cement and sand, or should be tiled.

Drab Distemper for Walls.—For drab distemper for walls, melt 21b. of Scotch glue in 1 qt. of water. In another vessel mix 141b. of powdered Paris white to a thick paste with cold water, and add sufficient dry umber and a little yellow ochre to form a drab of the desired shade. Now stir the glue into the colouring matter and allow it to cool down, then add sufficient cold water until the required consistency is obtained, when the distemper is ready for use. Another method is to mix together 11b. of common dextrin, 2oz. of alum, 10 lb. of Paris white, \$1b. of dry umber, and 2oz. of yellow ochre. Pass all through a fine sieve, and mix well together. To prepare for use, add sufficient cold water to form a paste. Both the above recipes are easy to prepare, and will not rub or peel off when dry.

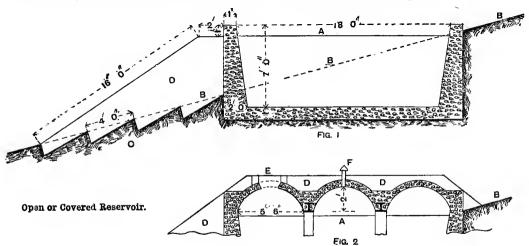
Miniature Torches.—Miniature torches are made by wrapping round an ordinary tallow candle a piece of stiff paper rendered non-inflammable by dipping in a strong solution of borax or alum and drying; the paper does not burn, but serves as a support to the melted tallow.

Staining and Varnishing Rustle Work.—Here are brief instructions on staining and varnishing a summerhouse that is built of oak and weather board. Stain both woods a dark oak by means of a water stain. To prepare the water stain, procure \(\frac{1}{4} \) b. of raw sienna and \(\frac{1}{4} \) b. of burnt Turkey umber, ground in water, and thiu down to the proper consistency with \(\frac{1}{4} \) pt. of liquid ammonia and \(\frac{1}{4} \) gal. of cold water. Apply with a brush in the ordinary way; two coats will be necessary for the white wood. Allow to dry, then give a coat of glue size and again allow to dry, finally finishing off with two coats of hard outside oak varnish.

Open or Covered Reservoir for Storing Water.—Fig. 1 shows an uncovered reservoir (with dimensions) capable of containing 12,000 gal.; this reservoir is enitable for the storage of water intended for manufacturing and irrigation purposes only. Water for domestic use should be stored in a covered reservoir; a suitable roof for Fig. 1 is shown in Fig. 2. On the top of a covered reservoir 1 ft. to 2ft. of earth should be placed, in order to keep the water cool, and ventilators should be placed in the corners of the arches. The walls and bottom of the reservoir are built in concrete, and the inner surface is rendered with cement, which should be brought to a perfectly smooth surface with the trowel. The usual accessories are the inlet and outlet, the overflow, and wash-out pipes. The inlet may be fixed on the most convenient side, about halfway up the wall, and so

dissolve the salts and mix the two solutions. Coat the paper with a brush and dry quickly. Print until a yellow image appears, then transfer the paper to oxalic acid 15gr., gallic acid 12gr., water 40 oz. Pass through a bath of citric acid 1 in 80 and wash for half an hour. In order to obtain light blue lines on a paler blue ground, coat any well-sized paper with oxalic acid 1 part, ferric chloride 2 parts, water 10 parts. Develop in a 20-per-cent. solution of potassium ferrocyanide, wash well, immerse in 3-per-cent. hydrochloric acid, and rinse.

Restringing Tennis Racket.—For restringing a tennis racket, if the old strings are not available for use, procure new gut, though the old gut may be softened by steaming. If the strings have not been removed, careful note should be taken of the method adopted of working from vertical to horizontal, the starting point, whether single or double strings, and also that they overlap each other alternately. The tools required are a small hammer, a piece of \$\frac{2}{3}\$-in. round rod of hard wood, one end of which has been cut flat and a piece of cloth or leather glued on for use as a strainer, and a quantity of hardwood pegs about \$2\text{in. long, tapered from \$\frac{1}{3}\$ in the point to a size that will just fit the holes already bored in the frame. Re-thread the new gut as originally done, secure one end by tying a knot, and pass through the opposite hole. Give a couple of turns a round the rod strainer, putting the covered end on the frame, gently strain the gut till it has acquired the requisite tension, then drive



arranged that the inflowing water may be shut off or diverted from the reservoir when it is being repaired or washed out. The outlet should be placed a few inches above the level of the floor, in order to allow any sediment to remain undisturbed. The mouth of the outlet should be covered with a tinned copper strainer. The supply is sometimes taken by a floating pipe which permits the water to be drawn from a little below the surface, the clearest portion of the water in a reservoir being near the surface. The outlet should be controlled by a sluice-valve fixed under the reservoir and worked from above by a wheel and spindle. The overflow consists of a vertical pipe (with an outlet at the base) carried up from the floor of the reservoir, having a hellmouth for receiving the overflow; the inlet at the base is controlled by a valve that acts as a wash-out pipe. The mouth of the wash-out pipe should be situated at the lowest point of the floor of the reservoir, which should slightly slope towards the pipe. The letter references are: A water level, B surface of ground with 30° slope, C benchings, D earth, E manhole, F ventilator.

White Colour for Relief Stamping.—Possibly it

White Colour for Relief Stamping.—Possibly it has been found that in mixing whites with varuish for relief stamping the result is not satisfactory, the colour being very dirty, and not drying white. A good white colour for white stamping is made as follows. Boil some ground rice to a paste and mix with Chinese white (in tubes), thinning with water if necessary.

Photographic Formula for Iron Printing.—In order to obtain black lines on white ground in iron process, prepare solutions of (a) ferrous sulphate 20 gr., tartaric acid 20 gr., ferric chloride 20 gr., distilled water 1 oz.; (b) gelatine 40 gr., distilled water loz. Soak the gelatine in cold water and dissolve by heat on a water bath;

in a peg. Continue the process till completed, and secure the points of overlapping by using coloured silk gut. When the ends are made secure, the pegs may be withdrawn, a piece of leather glued round the head, and the frame, which should have been previously cleansed with soap, salt and water, may be finished with white hard spirit varnish, applied with a camel-hair brush. The appearance will be smartened if the gut also is given a coat of varnish.

Preserving Brushes against Moths.—Proper ventilation has been found the cheapest and hest preventive against moths. If the goods are stacked, move them occasionally, turning the pile and well shaking the hristles. Powdered camphor or wormwood sprinkled about the room, shallow saucers filled with ammonia or turpentine and replenished after svaporation, are all good preventives. For goods that can he dipped without impairing their appearance or value, make up a solution of \(\frac{1}{2}\) lb. of alum, \(\frac{1}{2}\) lb. of cream of tartar, and l gal. of water. Allow them to get thoroughly dry hefore stacking. Brushes are best tied in bundles with a paper cover round them and hung from the ceiling.

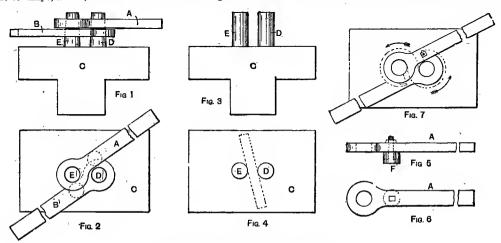
Polishing Turned Vulcanite.—To polish turned vulcanite finished with a scraping tool, take a haudful of vulcanite shavings and apply these as the article surgical bandage will do) by soaking in any sort of common oil, and sprinkle one side with putty powder (oxide of tin), then loop the prepared side round the article, holding the ends firmly with both hands, and work it evenly all over the article while the lathe is running, and finish the polishing in the same manner with a clean piece of linen without polishing medium.

Hair in Plastering.—Hair is used to make the lime and sand, or coarse stuff, hang together. The hair is obtained from the tanyard, and is usually specified as "long piled clean cowhair." The hair should be long, sound, and free from grease and dirt, and, if wet, should be dried. Before mixing with the mortar, the hair should be batted, beaten up, or switched with a lath until the matted portions are thoroughly separated. The usual plau is to put the hair on the plasterer's board, and the labourer, with a 2½ fit, lath in each hand, beats the hair until it is in a condition for use. The ordinary proportion is 1lb. of hair to 2 cub. ft. of stuff for ordinary work. If the coarse stuff is hand-mixed, the hair may be added with the other ingredients at the first: if machine-mixed, the hair should not be added nutil just before the stuff leaves the machine. This precaution is necessary in order to prevent the hair being broken into short pieces and thus wasted.

Steel Wire S Hooks.—For making a quantity of stenying schooks by hand, obtain a tool to the accompanying sketches. Figs. I and 2 show elevation and plan of the tool. 'The base C is made to fit either in the anvil or vice; E, D are the two stumps on which the hook is bent to shape, and A, B are the levers for bending the

copper may be used, but should be supported either by an iron plate with a round opening to fit it, or else by a couple of bricks just over the firebars, leaving the remainder of the pan in contact with the hot gases from the fire; by fitting the pan in this way it would be much more regularly heated, and the tendency to burn the fat or membrane would be much less. In rendering, sometimes I or 2 per cent. of sulphuric acid is added, but such treatment necessitates subsequent washing of the fat and a second heating to remove the water. The fat is filtered by passing through canvas bags in a warm room; when done on the large scale the filter press is used.

Cleaning Vellum.—This method, followed carefully, will restore dirty vellum to its original condition. Place the vellum on a board, and damp it well with a sponge, water being applied to both sides. The vellum will then get limp and will stretch. With the dressed side uppermost on the board drive tacks well in round the four edges, pulling the vellum outwards meanwhile as tightly as possible. Allow the vellum to dry naturally, when it will be found that all the creases have disappeared. To remove any obstinate dirt or stains, after the vellum has become dry, and while it is still tacked to the board, wash it with a weak solution of oxalic acid, say a pennyworth



Bending Block for Steel Wire S-Hooks.

hooks round the stumps. Figs. 3 and 4 show elevation and plan of the tool. Figs. 5 and 6 show elevation and plan of the levers A and B; F is a small roller which revolves when hending the hook. To make the hooks, take a piece of wire of the length required, and place it between the stumps, as shown by the dotted hines (Fig. 4), then place the levers in position, and work hoth of them round together; the arrows in Fig. 7 show direction in which the levers are to move, and the dotted lines show the hook after the levers have been pulled round. All the parts of the tool should be made of steel, and the wearing parts should be hardened. Make the stumps E and D slightly tapering, so that the hooks will slip off easy after they are bent.

Sulphuretted Hydrogen.—To prepare sulphuretted hydrogen, act upon ferrous sulphide with dilute hydrochloric acid. Usually, it is made in a gas-generating bottle, which is an ordinary bottle with a wide mouth, having a cock fitted with a thistle funnel and a delivery tube. The gas is passed through a little water in a wash bottle to purify it, and then into water, or, if required as a gas, into dry wide mouth bottles, from which it displaces the air. The hydrochloric acid used is the commercial acid diluted with three times its volume of water.

Rendering Tallow.—For rendering fats steam heating is almost universally adopted. By this the temperature can be better regulated than in any other way, and the whole mass in the pan is subjected to an equal heat. Fire rendering is only used for small quantities of fat, the expense of fitting up special plant not being justified, but this method does not product such a white product as when steam is used. For rendering tallow with an open fire, the pan should be moderately shallow and set in brickwork in such a way that the sides as well as the bottom of the pan are heated. A hemispherical iron pan similar to a washing

of acid dissolved in 1 pt. of water. It may be stated that in all skins of velum there are transparent patches and certain natural marks, which, of course, will not be removed. Vellum must not be touched with glasspaper, as this would spoil it completely. If it is thin and is intended for a book cover, it should be lined with white paper. This is best done by again tacking it on the board with the undressed side uppermost, pasting the paper, placing it down, and rubbing it thoroughly, afterwards allowing it to dry in this position.

Preserving Eggs.—For preserving a quantity of eggs, add 1 pt. of unslaked lime to 1 gal. of water, boil, stirring it well, then pour it into a bucket and allow to cool, and the lime to settle at the bottom. Now fill some glazed earthenware jars with new-laid eggs, then pour on the clear lime water to cover the eggs, tie a piece of bladder or some non-porous material over the top of the jars, and store away in a cool place. This is an old-fashioned method, and it has the objection of making the shells brittle, and to some extent gives the eggs an unpleasant taste. Anything that will seal up the pores of the shells will preserve the eggs, and coating with white of egg, or painting with gum-water, greasing, will keep them fresh for a time. At an exhibition in Birmingham, some eggs were shown that were preserved by rubbing with vaseline and packing in bran, and some were rubbed with lard and packed in peat mould. Water glass is now often used for preserving eggs. Water is hoiled and allowed to cool, then one-tenth of its bulk of water glass is added, and this is used in a similar manner to that employed with the limewater described above.

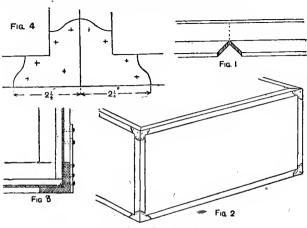
Removing Stains from Yorkshire Stone.—The removal of a brown stain from Yorkshire stone is a very difficult matter. The best plan would be to paint the stain the same colour as the original stone. The paint must be stippled, not smudged on, and not one person in ten will discover that the stone has been painted.

Dry Rot in Wood.—No method can restore soundness to timber in which dry rot has got a firm hold. All the diseased portion of the timber (and a little more, to be on the safe side) should be completely removed and replaced by good material, and every particle of the fungus should be carefully collected and destroyed, the safest plan being, of course, to burn all chips and dust, as well as the scrapings from the adjacent walls and floor. As a preservative of the new wood and of the undecayed portions of old wood, creosote oil is recommended. Two coats should be very thoroughly applied, with an interval of three weeks or a mouth between. The creosote oil can probably be obtained at the nearest gasworks, and may be applied with ordinary paint brushes. Carbolineum avenarius has a similar preservative effect. An application of a solution of corrosive sublimate would be quite effectual in stopping the further progress of the fungus, but the solution is difficult to apply in sufficient quantity to fixed woodwork, especially underneath affoor, and the use of this antiseptic is only recommended when steeping the wood is possible. The thorough ventilation of the premises should also receive attention.

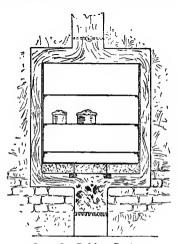
Aquarium Construction.—The size of an aquarium to hold about 18gal. of water will be 2ft. by 1ft. 6in. by 1ft. deep. The top and hottom frames may be made from iron in one length, 7ft. long, mitred at the extremities; the mitres at the three angles, cut in the solid,

plunger or ram is placed in this, and several hard blows with a hammer or mallet are given; this presses the plug into the mould to such a depth as will give a uniform thickness to the crucible. The plug is then withdrawn, the mould taken from the base-plate, and the crucible removed with gentle pressure and placed aside to dry. After being gently heated to drive out excess of moisture, the crucible is ready for use. The inner plug is formed with a shoulder which fits the edge of the mould and so ensures an even thickness of the crucible all round. Great care is needed in mixing the plumbago, or pinholing and other defects will ensue. Large crucible makers use a machine for mixing the materials.

Oven for Baking Pastry.—The accompanying sketch shows a method of forming the flues around an oven in the best manner to ensure the proper baking of pastry. For pastry baking a perfect bottom heat has been found to be essential. The oven can be of sheet-iron, but the two sides should have i_0 -in. cast-iron plates on them, or the heat may be too great. The bottom of the oven must have a heavy cast plate (say lin. thick) too protect it, or can have firebrick slabs carried on strong cast-iron bearers. Something of this kind is essential, or the oven bottom will be overheated; and it will also burn through quickly. The oven should have a frame around the front of it, and the oven door should be



Aquarlum Construction.



Oven for Baking Pastry.

(see Fig. 1) will be best cut out with a hack saw. When cut, the iron should be gently heated at each point and bent in the vice until the mitres meet. The mitre where the two ends meet may be brazed. The angle bars, 10 in. long, must be cut and filed square to butt-on the edges of the top and bottom frames; these are held together by shaped angle plates (see Figs. 2 and 3), marked out as shown by Fig. 4. The joints may be made additionally strong by brazing. A coat of paint should be given before bedding the glass to the iron.

Vinegar Plant.—The product known as the vinegar plant grows on the surface of a liquid undergoing acetic fermentation; this plant, in fact, causes the formation of vinegar if allowed to stand in contact with weak alcohol, such as beer or wine. The vinegar plant is really a tough, gelatinous mass of innumerable minute bacteria, and is not a plant in the ordinary acceptance of the term. It can only produce vinegar from weak alcoholic liquids; it cannot convert water into vinegar. The vinegar plant can be obtained by adding a little malt vinegar to ordinary beer, and allowing it to stand in an open bottle for a few weeks.

Lead Plaster.—Lead plaster is made by heating together olive oil, water, and lead oxide for many hours; it is really an oleate of lead.

Moulding Small Crucibles.—Small plumbago crucibles and also fireclay crucibles are usually made in brass or gunmetal moulds. A suitable mould is in three parts—a base-plate: a hollow mould, the inside being shaped according to the outside form of the crucible; and a plug, shaped according to the inside of the crucible. The base-plate is laid on a solid foundation, and the hollow mould is placed on this. Sufficient mixed plumbago is then put in the hollow mould. The

hung as usual. The furnace fittings can be the same as used for a washing copper. The oven shelves should be perforated, or have pieces cut out, to allow the air and heat to circulate. There should be a ventilator to the oven, as pastry gives off considerable moisture.

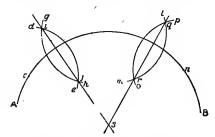
Jointing Small Wrought-iron Pipe to Large Castiron Pipe.—A 4in. pipe can by a skilled workman be drilled and tapped for a l-in. pipe, but if any doubt exists as to the man's skill, let small holes be drilled and opened out to about the required size with a diamond-point chisel. A saddle is then fixed on each pipe and the connection made. These saddles are to be obtained from firms who supply pipes, and are sent complete with screws and nuts so as to be fixed without difficulty by anyone; and as they are ready tapped for any size, all the workman has to do is to make the hole in the castiron pipe, and a rather rough hole will do.

Re-bottoming a Tub.—Here are instructions on re-bottoming a large tub, the chimb of which is worn. Saw off the chimb until the timber is found to be perfectly sound, and with the hollow draw-knife or adze bevel the ends of the staves to prevent spalling. As the bottom will now be too small, reduce the tub (this is less trouble and expense than making the bottom larger) by removing one stave and taking line off the edge. Rejoint the stave on a plane and return it to the tub, then replace the hoops. Level the ends of the staves by planing, then cut the groove or channel with a croze, as illustrated in Series II., p. 53. Now fit the compasses to the groove by going round it in six strides, returning to the same spot as was started from, or in over. Try the compasses on the bottom, and if its too large reduce it and plane up the edge to the same width as the groove; if the bottom is too small, take more out of the tub.

Moulding Indiarubber.—The following is the method of proceeding if it is desired to mould a piece of rubber tubing 24 in. long and 4 in. to 8 in. in diameter, with 4 in. walls. The pure rubber, after cleaning, is masticated and mixed with one or more of the following—lampblack, zinc oxide, antimony sulphide, china clay, French chalk or silica, and, of course, sulphur, which is added in about the proportion of 25 per cent. of the weight of the rubber to vulcanise it under the influence of heat. These adulterants are almost always used, as pure rubber is expensive. Rubber substitutes and old rubber are also often put into cheap rubber. The mixture is then treated with benzene in a closed chest until it becomes quite pasty and can be rolled out; it is then put through the rollers until it is reduced to the required thickness. The rubber sheet is cut to the desired size, powdered French chalk is dusted on it to prevent sticking, and it is then rolled ou an iron core of the internal diameter required until the edges meet. Canvas cloths are now wrapped tightly round the tube to keep it in shape, and the whole is heated in an autoclave at about 150°C. for four or five hours.

Finding Centre of Arch Curves.—The centre

Finding Centre of Arch Curves. — The centre points from which different arches are struck can be readily found by practical geometry. The most useful method of finding centres is shown in the accompanying illustration. Let A B be part of the curve of any arch; from any point c with a radius c d strike the arc d e, and



Finding Centre of Arch Curves.

from any point f with the same radius strike the arc gh to intersect with the previous arc at i and j, then a line drawn through ij will pass through the centre from which the arch curve was struck. Now take any point k and with any radius kl strike the arc lm, and from any point n with the same radius strike the ark op intersecting the previous arc in q and r, then a line drawn through qr will intersect with the line drawn through ij at the point ij, which will be the centre of the arch curve. When the arch has more than one centre, the various centres can be found in the same way, by taking different parts of the curve. This is a simple method of finding the centre of any arc of a circle.

Semi-rotary Wing Pump.—A semi-rotary wing pump has a hollow, drum-shaped head with solid ends, its lower portion being in the form of a sector of a circle, the two radii, or sloping sides, having valves in them which open upwards. A spindle passes through the centre of the ends of the head, and on this spindle are two arms which the close to the sides and ends of the head. A valve on the upper side of each arm opens upwards. The spindle is made to rotate a quarter of a circle by means of a straight lever handle situated outside. Suction and delivery pipes are attached to the bottom and top respectively of the head or drum. As the outside handle is moved to and fro, the arms inside rock up and down and raise water alternately. The patterns and castings for making such a pump would cost considerably more than the price of a finished article, and a power lathe would be necessary for boring out the drumhead and trueing up the ends. There would also probably be a trespass on patent rights in making such a pump.

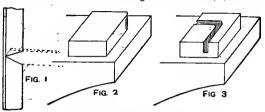
Removing Neck of Glass Carhoy.—Here is explained how to cut a large carboy top so as to leave a hole about il in. across. Fill the carboy with water to the height to be cut, and make an ink mark right round the bottle at that level; this is to serve as a guide for cutting. A crack may be started from the neck of the bottle by tapping with a hammer, and can be led to the ink mark by placing in frout of it a red hot iron wire, and moving the wire as the crack creeps on. When the ink mark is reached, carry the crack round the bottle by moving the hot wire in the desired direction. As the glass of a carboy is very thick, the work will be very slow, and a great many heatings of the iron will be kept perfectly rigid about \(\frac{1}{2}\) in front of the

crack, and moved along slowly. The last inch will not crack, but by the time this is reached the neck of the carboy can be lifted off.

Milk Powder.—Milk powder is made as is condensed milk, by the evaporation of ordinary milk in a vacuum pan at a low temperature and under considerably reduced pressure. For the production of a powder, the evaporation is carried on until the material is quite dry: it is then ground to powder. (See Series II., p. 268.)

Cutting Veneer Squares for Chess Table.—The readiest way of cutting veneer squares when a regular sawing frame is not possessed is to set a cutting gauge to the requisite width and run off sufficient strips of veneer. Shoot the edges with a shoulder plane, then place the strips side by side and run the cutting gauge across them in a transverse direction, when the squares will drop off perfectly true. The edges may also have a shaving taken off with the shoulder plane to square them. Provide a board long enough to hold a strip of veneer, and rebate the hoard slightly to hold the veneer whilst shooting. When the squares are cut off, place them side by side in the rebate and shoot them.

Bending Angle Iron.—A quick way to make corners in angle iron is to cut a V piece out of the bottom web (see Fig. 1). Scarf the two edges, bend the corner, and then weld up; before welding be sure to bend the corner a little more than the desired angle when finished (as shown by dotted lines) so as to allow for the corner opening during the welding up. If only an odd corner has to be made a tool like Fig. 2 will answer, but if a



Banding Angle Iron.

number of corners are to be forged, a tool as Fig. 3 would be preferable, as the corner can be better welded and can be kept to the proper angle at the same time.

Fastening Watch Mainsprings.—In some cheap Geneva watches the end-of the mainspring will be found to be bent back into a hook. It is difficult to bend a spring like this without breaking it. The best course is to rivet a short piece of spring on the end in the reverse direction. The braces for Waltham and similar springs are bought ready made and riveted on. The spring only needs a round hole punching in its end, which is opened out by broaching to fit the rivet on the brace. The spring of a fusee watch has a round hole punched in it. This hole is opened by broaching and filing to an oval shape, leaving a knife edge on the outside to hold the hook. Oblong holes need a mainspring punching tool and are of no advantage.

Modulus of Elasticity.—Dr. Thomas Young invented a modulus of elasticity which was the modulus of direct elasticity expressed in feet, being the height to which a body would have to be piled in order that any small addition to its top, of its own substance, might compress the remainder of the body to an extent equal to the thickness of the added quantity. Hooke's modulus was the weight in 1b. that would stretch a bar having a sectional area of 1 sq. in., by an amount equal to its own length. The modern definition of the direct modulus of elasticity is "the ratio of the stress per unit of section to the strain per unit of length produced by that stress." Expressed in 1b. the modulus of elasticity (E) is the tensile or compressive stress in 1b. per sq. in. sectional area divided by the elongation or shortening in inches per inch in length. The figures are E = for mild steel 29 millions, wrought-iron 26 millions, cast-iron 18 millions, hard wood 2 millions soft wood 14 millions. The modulus holds good only within the limits of elasticity, that is, so long as the strain is sensibly proportional to the stress, or in general up to about half the breaking weight.

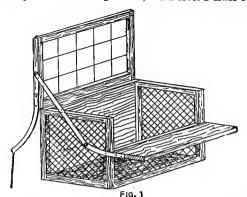
Reviver for Felt Hats.—The following is a reviver for

Reviver for Felt Hats.—The following is a reviver for black felt hats. Take 1lb. of logwood chips and boil with 1 qt. of water for two hours; strain, add a little water to the chips, and again boil and strain; make the total up to 32 oz. if below that bulk. Dissolve in the solution 1 oz. of chromate of potash (not bichromate), when the reviver is ready for use.

Enamel Painting Cycle Olive Green.—It is necessary to remove the old enamel with a hlunt knife, finishing by removing all small particles with superfine emerypaper until a perfectly even surface is obtained. Dust well, and apply a coat of clive green enamel made by mixing together 1 lb. of paste coach green ground in turpentine with 1 oz. of lemon chrome, thinning down with 6 parts of outside copal varnish and 1 part of pale gold size. The best and most even surfaces are obtained by slightly warming the enamel before use. The enamel, if mixed in the above proportious, will dry hard in a few hours with an excellent gloss, and will not crack or chip off. The appearance of the cycle may be somewhat improved by lining out with middle chrome paint.

improved by lining out with middle chrome paint.

Pigeon Trap.—Fig. 1 is a design for a pigeon trap, 2ft. 10in. long by 1ft. 6in. deep by 1ft. 3in. wide, the top to open by means of a pulley arrangement, and the front to drop. It is framed together with 1½-in. by 1½-in. deal, with a back of ½-in. matchboarding, and a bottom of ½-in. matchboarding. The lid may be framed together of ½-in. by 1-in. stuff, and either divided into 4-in. squares with wires, as shown, to enable the pigeons to get in when the trap is closed or catch any stray ones that may be about, or the lid may be boarded over. The front and sides are covered with wire netting, except the npper portion of the front, which falls down to form an alighting shelf when the trap is open, and closes up when the lid falls. Fig. 2 shows the arrangement for working the trap. The lid is hinged at A, and a lever B made of

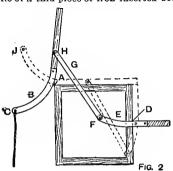


ferment; two or three inches of the liquid to be fermented is then poured on the upper partition; the liquid passes slowly through the cotton wicks and drips on to the shavings, where the fermentation takes place, and then falls to the bottom of the cask, and when the liquid reaches the level of the upper part of the glass tube it syphons out. If the cask is placed in a warm room and the ferment is in full activity the liquid will at once be changed into vinegar. Slightly diluted beer should be used for making vinegar, but if the vinegar is to be made from sugar, then the sugar solution must be fermented for twenty-four hours with yeast in an open tub before patting it through the vinegar cask. If the vinegar is not quits clear, litter it through a piece of white blotting paper folded in a funnel. For further particulars, see Series I., p. 265.

Replacing Head in Cask.—Below is explained how to

particulars, see Series I., p. 265.

Replacing Head in Cask.—Below is explained how to replace an undowelled head (removed for cleaning purposes) in a cask. Replace all the pieces of the head in their original positions. Nail a strip of wood across the joints to keep the pieces together, taking care that the nails do not go quite through. Return the head to the cask in the same position it was before being taken out (the position should have heen marked with a punch or chisel). If in doubt, look for the impression that each stave makes on the head. Take off sufficient hoops to allow the staves to spring open, pisce the head in the cask and pull towards you, the cask lying on its side; tighten the hoops sufficiently to hold the head in place, and any portions that refuse to come into the groove easily can be lifted in by means of a thin but blunt table knife or a thin piece of iron inserted between the



Pigeon Trap.

l-in. by \(\frac{1}{2} \) in. bar-iron is secured at one end on the hinged side by a couple of screws. A cord is attached to the other end at C. The top of the front is hinged at D, and fitted with a lever E similar to B. A connecting-rod G is attached to this lever at F by a small bolt, and the other end of G is attached to the lid at H by a wood screw. The dotted lines show the trap closed, when the cord will be at J, and it will be clear that by pulling this cord the lid will open and the front flap will be secured to a cleat or a hook. On releasing the cord, the weight of the lid closes the trap.

Sizing Gilt Face of Clock.—Varnish should not be

Sizing Gilt Face of Clock.—Varnish should not be needed on a gilt clock face. If the gold was evenly and well put on when the size was at the right state of tackiness, a thin coat of size, as clear as possible, is all that is required; parchment size such as picture-frame gilders use is preferable. When the face of the clock becomes dirty through dust or other causes, the size can easily be taken off with a little warm water, thus removing the dirt, and a fresh coat given. This is the most durable method of protecting the gold on a clock face; varnish takes away the brightness of the gold and imparts a brasey appearance.

brasey appearance.

Making Vinegar from Sugar.—By a quick process of making vinegar a cask is fitted with a partition a few inches above the bottom; this partition is perforated, and acove it is loosely laid a heap of hardwood shavings or vine twigs which have previously been boiled with water. The shavings nearly fill the cask, and a few inches from the top of the cask a perforated lid is fitted in. Each of the holes in this lid is fitted with a glass tune rising about 1 in. above the surface of the wood, and through each tube is passed a wick of untrimmed cotton yarn. In the side of the case, between the bottom and the partition, is a hole plugged with a cork, through which passes a glass tube hent round in the form of an inverted U, so that it serves as a syphon. The process is started by passing through the cask some vinegar, preferably some with the fermentation in progress, for the purpose of inoculating the shavings with the vinegar

joiuts of the staves; a small rush as used by coopers placed all round the groove would make doubly sure. To peg the head together, in one piece of the head at 4in. from each end bore a hole, then place a piece of chalk in the holes bored and rotate for the purpose of marking the inside edges of the hole. Place this piece of the head on the top of the next piece in the position required and then strike smartly with the hammer once, when an exact imprint of the hole will be seen on the piece underneath. Bore the holes out with brace and dowling bit and fit the dowels to the holes tightly, then proceed with the other pieces in a similar manuer.

Papier-maché.—Papier-maché is made from paper pulp, which may he produced on a small scale by boiling white hlotting paper with water and heating it to pulp. On the large scale, papier-maché may he made from white rags or wood pulp. The pulp should be drained as much as possible of its water, and then mixed in a kneading machine with about one-eighth to one-fourth its weight of whiting and just sufficient glue size to make it into a stiff paste. It may be moulded easily by hand pressure in a small screw press. For white papier-maché all the materials should he absolutely white, and parchement size or gelatine should be used; but for coloured papier-maché, glue size can be employed. The pulp can be coloured by any mineral pigment, as lamphlack, ochre, etc., or may be tinted with aniline dyes. The pressed boxes should be dried slowly, or they will not keep their shape. As papier-maché, if kept in a damp place, would hecome mouldy, it is hetter to varnish or lacquer it, after applying a coat of size.

Patching Worn Nickel-plating.—Cempositions for

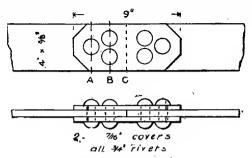
Patching Worn Nickel-plating.—Compositions for patching the worn parts on nickel-plating are not to be recommended for several reasons, and must be regarded as makeshifts, similar to that of tying a broken part with string or wire, instead of soldering or hrazing the joint, or painting a worn spot in the enamel. Worn parts in the plating and the enamelling of cycles can only be thoroughly repaired by getting off all the old coats, and putting on new ones.

Scorched Chrome Leather Boots.—If the scorch is very bad, the best thing will be to cover up the defective place with a piece of leather to match as uearly as possible the colour of the boot, using Sand's cement. Skive the bad part from the boot, and round and skive a piece of new leather to cover the scorched place. The scorched place and the new patch should receive each a coat of the cement; if the leather is not white all over when dry, give a second coat of cement, and when the cement has dried white, warm the two surfaces, place them together, and when cold the boots can be worn. If time will not permit of a patch being put on in the manner described above, the hardness of the burnt part may be somewhat neutralised by a little warm water.

Joining Wroughtiron Plate—Suppose a wrought.

somewhat neutralised by a little warm water.

Joining Wrought-iron Plate.—Suppose a wrought-iron plate, 4 in. wide and $\frac{1}{2}$ in. thick, to be built into a large block of concrete, 18 in. of the plate projecting vertically, and that it is desired to join a second plate of the same size to the first so as to obtain the maximum strength in tension. A double-cover riveted joint, shown in the accompanying illustrations, is the best. The full strength of the plate will be $4 \times 4 \times 22 = 55$ tons. Each $\frac{1}{2}$ -in. rivet would have an ultimate strength in double shear of 15 tons, or 40 tons per sq. in. bearing pressure. The resistance to fracture through the first rivet hole A would be $(4-\frac{3}{4}) \times \frac{1}{8} \times 22 = 447$ tons. The resistance to tracture through B and shear A would be $(4-\frac{1}{4}) \times \frac{1}{8} \times 22 + 15 = \frac{49}{4}$ tons. The resistance to shear all the rivets on one side would be $15 \times 3 = 45$ tons. The resistance to tear the covers at C would be $2(4 \times \frac{3}{8}) \times 22 = 66$ tons, but



Joining Wrought-iron Plate.

this could not happen, owing to the loss of section in the adjacent rivet holes making a weaker line. The resistance to tear the covers through B would be $2\times (4-14)\times 2=4125$. The resistance to crush all the rivets in the holes on one side of joint would be $3\times 2\times 4\times 40=55$?25 tons. The weakest part is therefore the tearing of the covers through B. This may be improved by increasing the thickness to $\frac{1}{12}$ in. each, when the strength will be brought up to $2\cdot (4-1\frac{1}{2})\cdot \frac{7}{12}\times 22=481$ tons, which the weakest part now through the plate itself at the first rivet hole, and as the number of rivets here cannot be further reduced, this is the maximum strength, or an efficiency compared with the original strength of the plate of 81 per cent.

strength of the plate of 81 per cent.

Inserting New Tube in Barometer. — When replacing an old tube in a barometer by a new one, it is always well to obtain the new tube as nearly as possible like the old one, not that it makes very much difference, except where the graduated scale is corrected empirically, as in marine barometers, so as to get rid of the error of capacity. This correction depends on the relative diameters of tube and cistern; but where there has been no such correction, the shape of the tube is immaterial. As the pressure which the mercury exerts by its weight at the base of the tube is independent of the form of the tube, provided it is not capillary, the height of the barometer is independent of the diameter of the tube and its shape, but is inversely as the density of the liquid.

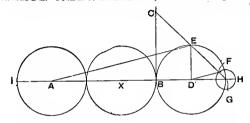
Moulding Carnauba Wax.—Carnauba wax, which is obtained from the leaves of a variety of palm tree growing in Brazil, is very brittle and shrinks very much on cooling; on coming in contact with the cold mould the wax solidifies on the outside, while the inner portion is fluid, and this sets up great stress which fractures the mass. To meuld it properly, have the moulds (which may be of iron or brass, or even tinplate) much larger than the tablets required, and bring them to a temperature above the melting point of the wax, i.e. 81°C. Add 5 or 10 per cent. of tallow to the wax and then cast, then put the moulds in a warm place, free from draught, and allow to cool slowly. The colours to be used will depend on whether an opaque or a translucent wax is required;

if opaque, for red use venetian red; for red brown use burnt umber; and for brown use umber. If translucent colours are required, instead of tallow use 5 per cent. of oleic acid (olein), and add sufficient of one of the ani-line colours soluble in oil to give a tint only; the amount required will be found to be very small.

required will be found to be very small.

Brown Stains for Oak Picture Frames.—For a light brown stain for oak frames, dissolve to z. of bichromate of potash in 1 pt. of rainwater, and add brown umber in dry powder form till the tone desired is gained. To prepare a dark brown oak, mix the potash solution as above with vandyke brown instead of umber. Or, as au alternative plan, mix the vandyke brown with liquid ammonia to the consistency of paint, then thin out by adding rainwater. To use the stains, apply liberally with a hog-hair brush (a painter's sash tool), then with a piece of coarse rag rub the stains well in, wiping off any surplus, but always finishing in the direction of the grain. As the solutions have a darkening effect on oak, irrespective of the pigments that are added, it will be advisable to experiment first on a few odd pieces of similar woods. on a few odd pieces of similar woods.

Graphic Method of Determining Circumference of Circle. The following is a graphic method of determining the circumference of a circle, the error being but about $\frac{1}{18,500}$. Required the circumference of a circle having its centre at X in the illustra-tion. Produce the diameter both ways, describe two circles equal to the given circle and having their centres A and D on the produced diameter, each circle touching the given circle at opposite sides. Erect a perpendicular radius D E. Join A to E and E to G, and draw D F parallel



Graphic Method of Determining Circumference of Circle.

to AE. With Gas centre and GFas radius describe a circle. Then HI equals the required circumference of circle. For the proof, draw BC perpendicular to AD, and make it equal to the diameter of the given circle. Produce GE, when it will meet BC at C. Then GC = $\sqrt{2}$ = 141.2 the unit being the diameter of the circle. GF = GI and it can be shown that GF = $\frac{EG \times DG}{AG}$ = $\frac{\sqrt{2}}{10}$ = 0.14142. Thus H I = three diameters + GH = 3.14142. The true circumference is 3.14158 (approx.), the difference being 00016.

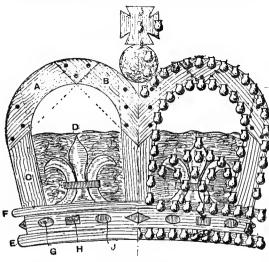
Stamping Blacklead Pencils.—For stamping the plain letters on blacklead pencils, at some works two circular dies are fixed with their edges nearly touching. The edges are grooved to the diameter of the pencils, or a little less, and the dies are kept together by springs. On the groove of one die raised letters are fixed, and the pencils are pushed between the dies, and fall out on the opposite side stamped. The dies are so arranged that the letters are brought back to the front side after the stamped pencil has dropped. For gitl letters, the stamp works in a vertical guide, and is heated by a small gas jet, the pencils being coated at the proper place with gold size. A strip of gold-leaf is then laid on, and the pencil is placed in a rest formed under the stamp, which is pushed down by hand, this forms the letters, and pushes in the gold at the same time. The surplus gold-leaf is rubbed off into a box with a piece of clean cloth. Stamping Blacklead Pencils. - For stamping the

leaf is rubbed off into a box with a piece of clean cloth.

Black Liquid Polish for Leather.—Herewith are three recommended recipes for a black liquid polish for leather. (a) Take ½ oz. of isinglass or gelatine, ½ oz. of powdered indigo, ¼ oz. of soft soap, ¼ oz. of logwood, and 5 oz. of glue; boil these in 2pt. of vinegar till the glue is dissolved, then strain through a cloth and bottle for use. (b) Melt 8 oz. of beeswax in an earthen pipkin, and stir into it 2 oz. of ivory black, 1.oz. of Prussian blue ground in oil, 1 oz. of oil of turpentine, and ½ oz. of copal varnish. Make this into balls. Apply with a brush, and polish with a soft rag. (c) Mix well together 4 oz. of treacle, 4 oz. of lampblack, a tablespoonful of yeast, and a teaspoonful of oil of turpentine; apply with a sponge; no brushing is required. Each of the above preparations should be kept in a cool place.

Dull Black for Wrought Ironwork.—The following is a recipe for a quick-drying dull black for wrought ironwork. Meltin an old fron vessel 1 lb. of asphaltum and 1 lb. of coal-tar pitch; simmer for half an hour, and allow it to cool somewhat, then add 1 pt. of boiled oli. Place the mixture over the fire again, and raise it to a good heat, then add ½ lb. of litbarge while constantly stirring; boil for some minutes until the mixture turns stringy. Allow it to cool down slightly, and steadily add ½ gal. of turpentine. In another vessel dissolve 1 lb. of beeswax in ½ gal of turpentine, and stir this into the above preparation, which will give to it a dull surface when dry. The quantity of beeswax to be added will vary according to the finish required. Another method is to procure 1 gal. of black japan, and add to it 1 lb. of beeswax dissolved in ½ gal. of turpentine; stir well together, and add ½ pt. of terebine.

Illuminated Grown.—The illustration herewith shows a sketch of a crown for outside illumination in woodwork, to take fairy lamps, the base of the crown to be about 5ft. and the height 4ft. Alterations and improvements can be made to suit individual taste. A and B are cut from 9-in. board # in. thick; C is cut from 6-in. stuff. Each flenr-de-lys is cut out and fixed on the background D,



Illuminated Crown.

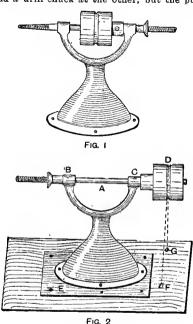
which is painted with one coat of red-lead, on which is put a thin coat of Indian red and varnish to represent the velvet of the crown. The crown, as it is only used as a peg to hang the lamps on, could be painted either black or in ochre. The jewels in the band could be cut out, and green, blue, and ruby glass, with lights behind, placed at the back of the openings G. H. and J. Round the arc of the crown the lights should be white, to represent pearls; on the band F-the lights should be yellow, to represent the golden cord, and on each fleur-de-lys also yellow. At E the lights should be white, to represent the ermined band. Four yellow lamps could be clustered in the orb and five on the Maltese cross, one in the centre and one on each side and at top and bottom.

Fiving Register Grate and Mantel.—The following

Fixing Register Grate and Mantel.—The following are particulars on fixing a register grate and mantel. The jambs and frieze of the mantel, in the first place, must be offered up and their inner edges marked to show the position of the grate. In fixing an ordinary register grate which is wholly ironwork (except for two or three small firebricks in the firebox) the grate is merely stood in the chimney opening, then through the register aperture the space behind the grate is filled up with brickwork. For good working, the grate should be filled up hehind and all around the sides, and the filling is also necessary in order to prevent soot accumulating. If the grate is a modern one, having all firebrick back and metal front, then the mantel and the grate front must be offered up to show the position of the bricks, as these are fixed first. The bricks are stood in position and well bedded round with mortar (lime) concrete, then the front is put up and may or may not be secured to the firebricks with bands or clamps. Sometimes the bricks and the front are sent from the works secured together, and in such case the grate is fixed like the iron register grate as explained above. Mantels are fixed jambs first, and these are eccured to the wall by iron

clamps; then comes the frieze, which requires no securing, but a slate plinth will probably be sent to fit in between the lower edge of the frieze and the grate. Then comes the shelf, and as a rule a chase, about 1 in. deep, is cut in the wall in order to let the back edge of the shelf go in, and is made good with cement.

Emery-wheel Grinder on Sewing-machine Stand.—Below are instructions on converting an ordinary sewing-machine stand into a treadle emery-wheel so that the wheel can be covered with the machine cover. Most emery grinders have the pulley fixed about the centre of the spindle (see Fig. 1), and frequently have an emery wheel attached to each end, or an emery wheel at one end and a polishing buff at the other. But if it is desired to use the machine cover in exactly the same position as for the sewing machine, the better plan would be to purchase a cheap emery grinder (Fig. 1), and adapt it to the sewing-machine stand. The grinder is constructed to hold an emery wheel at one end and a drill chuck at the other, but the pulley is



Emery-wheel Grinder on Sewing-machine Stand.

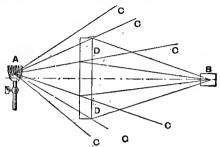
in the centre of the spindle. A set of castings for the above, which consists of the following, should also he bought. One stand, 6:in centres with two adjustable bearings cast on, two brass clams, one spindle, and one pulley, and boring and cutting bearings. Proceed to build the grinder as Fig. 2. Insert the spindle A in the bearings B and C, and attach the pulley D on the right-hand side of bearing C. To fix the grinder to the stand, get a deal board E, 9in. by lim, and of sufficient length to cover the hole in the machine table, and secure it with six l\(\frac{1}{2}\)-in. No. 12 wood serews; place the grinder on top of this board, attach a belt from pulley D to the driving wheel on the stand through the holes F and G in the table. Should the belt bind fore or aft, slot the belt-holes. Set the groove in the pulley D in line with the driving pulley and fasten the castings with wood screws. The depth of the machine cover should be taken into consideration when ordering the casting for the grinder so as to obtain one sufficiently low; 5 in. from base to centre of hearing would be a convenient height.

Colour Wash for Yellow Stock Bricks.—Below is a recipe for a colour wash for an old yellow stock brick wall. The colour of the bricks may be imitated by using, in varying proportions, slaked lime and yellow ochre; if a darker shade is required, add a small quantity of dry umber. To each bucket of wash add li lb. of alum or of white copperas. The proportions given below will suffice for most purposes. Lime, li lb.; yellow ochre, dry, 7 lh., and l lb. of either alum or white copperas, or green copperas; about 2 gal. of water or sufficient water to make a wash of the required consistency should be added. Apply with a fairly stiff brush,

Emerald Green Enamel Paint.—Green enamel paint may be prepared with emerald green ground in varnish 2lb., maple or carriage varnish 2 pt., gold size \$\tilde{p}\tilde{t}\tilde

Treatment of Rusty Piano Wires.—When a piano has got rusty throughout in consequence of damp, take the instrument apart and leave it open for a week at least, so that air can play freely around its parts to dry up any moisture. A warm room and sunshine will be beneficial. The instrument may also be freely used to prevent any centres swelling and working stiffy. The action should be taken out to enable the wires to be lightly brushed with a blacklead brush that has been used on grates. Remove any dust by means of bellows, then wipe the wires over with vaseline applied on a washleather. Should the instrument be in a very bad state, more thorough treatment will be necessary.

Difference between Photographic Lens and Condenser.—A lens is a disc of some suitable substance (usually glass) whose surface is fashioned into a more or less spherical shape; it is capable of transmitting and refracting light rays. Lenses have been made of glass, water, Iceland spar, quartz, and even of ebonite. Generally speaking, a condenser, although a lens, is



Design showing Use of Condenser.

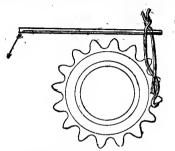
nsed for a slightly different purpose than the ordinary photographic lens. A condenser usually consists of two glasses (one side of each of which is flat and the other spherical) fixed in a tube, the curved surfaces of the glasses being together; the condenser is used to bend together the rays proceeding from a small source of light. For example, in the illustration, if the gas flame A is used to illuminate the openings B, all those rays of light proceeding in the direction C will be lost; but if a condenser D is put in the path of the rays, they may be bent together and used to enrich the light. A condenser, therefore, is a lens of large diameter that is used for the purpose of obtaining brighter and more even illumination when enlarging small pictures. Condensers need not be (and usually are not) corrected for the various faults or aberrations that lenses are liable to, and cannot therefore be used for the same purpose as an ordinary leus. Condensers are used chiefly in lanterns for enlarging and projection, and small ones are in use for illuminating opaque objects that are being examined in the microscope.

Maize Starch.—The following is an outline of a largely used process for preparing maize starch. The grain is steeped for three days in warm water at a temperature of 60° C., and a small quantity of bisnlphite of lime or other preservative is added to prevent fermentation. The wet grain is then ground between rollers and passed to shakers, which are long cloths stretched on frames kept in constant motion. The shakers act as sieves, allowing the fine material to pass through, while the coarser material is kept back and put through grinding rollers again. The liquid containing the starch in suspension falls through the shakers into large vats which, heing conical at the bottom, are called settling cones; in these the starch is allowed to deposit and the water is run off. The wet starch is next run into mixing vats, a large amount of water added, and also a small quantity of alkali to neutralise the acid generated. The starch is allowed to subside, then is run on to tables and the water run off; a second washing with water, followed by subsidence, is usually given to remove the impurities. The purified wet starch is run into wooden boxes,

made slightly taper and with a perforated bottom to allow of drainage. After draining, the starch slabs are emptied on to a table, from which the remaining water is removed by a vacuum pump, and the blocks of starch are loaded on trucks containing shelves and then run into drying kilns. These are built of wood, and hot air is drawn over steam pipes right through the kilns by means of a fan. There are also subsidiary operations connected with the removal and treatment of the germ and oil, which now are also valuable products.

Irregular Stitching in Sewing Machine.—The variation in a sewing machine stitch may be caused by the feed being too low or the teeth not sharp enough. For wax-thread work the feed should be at least \(\frac{1}{2} \) in above the needle-plate when the needle-bar is at its highest point. If too low, dovetail and braze a piece on the under side and file it until the required height is obtained. If the teeth are worn smooth, soften the feed in the usual way and recut with a three-square file. Another cause of irregular stitching may be the general looseness of all the feed and stitch regulating parts. To test this, turn the wheel of the machine until the needle-bar is at about its highest point of travel and the feed about to move to make the stitch, then with the thumb and finger try to move the feed backwards and forwards: if by so doing much movement is obtained, it will be obvious that some parts are worn and must be refitted or replaced by new ones.

Removing Chain Ring of Cycle.—The accompanying illustration shows a simple makeshift device that cyclists may employ in removing a tight chain ring, which



Removing Chain Ring of Cycle.

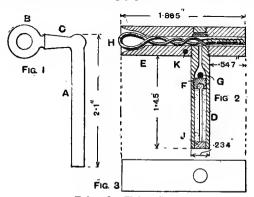
is often a troublesome affair when a chain-ring wreuch is not available. A piece of stout wire is bent as shown to fit over the teeth, and an iron bar or anything handy is inserted to act as a lever. This will be found to move any chain ring, however tight.

Discoloured Hot Water.—The red-brown discoloration of water in a hot-water apparatus is due to rust, which is probably caused by the nature of the water, which presumably is soft and has a solvent action on iron and steel. Soft water also attacks zinc (and lead) just as freely, so that the galvanisation of iron is not a protective. If any iron is in the apparatus (the pipes, for instance), the discoloration of the water is accounted for. If all the apparatus is now of copper, the trouble is caused by sediment, and the discoloration would only be noticed when the water is agitated by, for instance, boiling. If the pipes are of iron, they had better be changed to copper. Some people use lead, but the water be changed to copper. Some people use lead, but the water way attack this metal, and although the dissolved lead will not be visible, it will be a source of risk, owing to its poisonous properties, if the water is used for filling kettles, etc.

Repairing Water Jacket of Gas.engine Cylinder.—
In the case of the outer shell of a gas-engine cylinder jacket having had a piece broken out by frost, the only repair that is reliable and can be recommended is the following. Have a piece of wrought plate forged to the shape of the cylinder where the fracture is and about 2in. larger all round. Assuming the broken piece can be put in place without dropping through the hole, bed it in with mixed red and white-lead about as thick as stiff paint, then with the same mixture paint over the inner side of the forged plate and the surface of the cylinder it will come against. Next mix red- and white-lead to the consistency of sticky putty and into this work some chopped hemp. With this make a plaster a full ½ in. thick over the inner side of the forged plate, and then bed it soundly on the cylinder, entirely covering the broken place, of course. The plate is then secured by fin. or ½-in. set screws placed about 2 in, apart.

Removing Stain from Dressed Stones.—In packing newly wrought stones in oak shavings, the dye from the shavings may he found to penetrate the stones, the bluish stain heing no doubt a taunate of iron, the taunic acid coming from the shavings, and the iron is present in the cream coloured sandstone. The stain may be removed by soaking the stones for several hours (or perhaps longer) in dilute hydrochloric acid (1 pt. commercial hydrochloric acid or spirit of salts to 10 pt. of water); after the acid bath the stones should be soaked in water for a day or two, and then left in a clean place to dry.

Tubes for Firing Guns.—Guns are fired by means of two kinds of tubes, one firing charges of black gunpowder, the other firing charges of cordite. The latter are called vent-sealing tubes. In the first kind (Fig. 1), the tube A is of solid-drawn copper and has a solid head B; It is about ½ in. in diameter, and 21 in. long. The inside is filled with pistol powder, and the bottom is closed with a cork plug secured by shellac. Across the top of the tube is inserted a nib piece C or short cylinder of sheet copper. This nib piece contains a copper friction har roughened on both sides and covered with a detonating composition. The nib piece is pinched down so as to press on the sides of the friction har, the projecting part of which has a vertical eye into which the hook of the lanyard fits. On pulling the lanyard (which should be stretched and then sharply pulled) the friction bar is



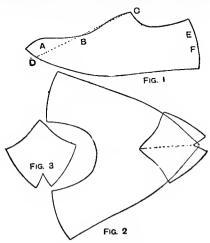
Tubes for Firing Guns.

drawn out, igniting the composition and firing the tube. The gas from the exploded cartridge drives this tube out of the vent. The vent-scaling tube (Fig. 2) has been adopted for use with cordite, to prevent the gas on discharge rushing up the vent, and so scoring it and making it become dangerous. The tube consists of a body D, head E, ball F, plug G, and friction wire H. The head is of gummetal, the body of solid-drawn brass, the ball of soft copper, and the friction bar of doubled copper wire, the bight being formed into a loop and the ends twisted together and roughened. A hole in the head of the tube, over the friction wire, is charged with about 2 grains of detonating composition in the form of a paste, laid over the roughened portion of the wire. The body is charged with 8 grains of pistol powder, and is closed with a cork plug J. A brass pin K is inserted to prevent the body becoming unscrewed. The upper part of the hody has a central perforation which is enlarged in its lower part into a conical recess. The ball E is placed in this recess, and is retained therein by a screwed plug G pierced by three fireholes. On withdrawing the friction bar the detonating composition is ignited, and the flash passing down the perforation in the head and through the plug, fires the powder charge. The ball is driven upwards by the explosion and seals the tube. This, together with the manner in which the tube is held in the special vent employed with it, prevents the rushing of gas through the vent.

Pike Fishing Rod.—A three-part rod may be made to these dimensions. Butt, 4ft. 6in. long, with a 4-in. diameter ferrule at the top; middle joint, 4in. in diameter at the counter and 4 in. at the ferrule, both joints to be made of bamboo; top, 4 in. in diameter at the counter, tapering to 4s in. at the point, made up by splicing 2ft. of lancewood on the top of 2ft. 6in. of washaba or, if this cannot be obtained, hickory or ash. A four-part greenheart rod may be made to the following dimensions. Butt, 3ft. 6 in. long, 14 in. in diameter at the handle, and 4 in. at the first ferrule; second joint, 3ft. 6 in. long, and 4 in. in diameter at the top joint, 3ft. 6 in. long, and 4 in. in diameter at the top

ferrule; top, 3ft. 6 in. long, and A in. in diameter at the point. A light rod may have the lower joints of pine or red deal with a laucewood top or a spliced top as for the bamboo rod, and may be to the following dimensions. Butt, 3ft. 4 in. long, tapering from 1½ in. to ½ in. in diameter; middle, 3ft. 4 in. long, and ½ in. in diameter at the ferrule; top, 3ft. 4 in. long, tapering to ¼ in. in diameter at the point.

Hollow Boot-last.—Below are instructions on making a boot-last with the instep fixed, not loose as in ordinary lasts. The form of the last is to be hollow, so that a wood bottom can be fixed in. Make a last with soft buckram; as two or even three thicknesses of buckram will be necessary, it will be hest to cut the pieces so that all the seams will not come in one place. Cut out the last to Fig. 1, noting specially that it should be rounded off at the top of the toe as st A. Two of these pieces will be needed for each last, unless three thicknesses of huckram are used, then four pieces will have to be cut. Now fold a piece of paper and get the fold as level as possible to BC, as shown by the dotted line down to D, and cut it out to the first pattern. This will



Hollow Boot-last.

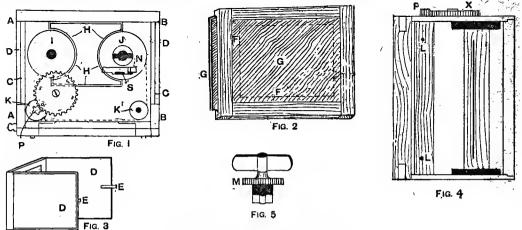
give, when open, the shape of Fig. 2; a piece can be cut to this, and another to Fig. 3; in the form of a toe-cap (see Fig. 2). Before working the pieces, each one can be steamed or slightly damped. Take one piece (Fig. 1) and tack it, as when lasting a shoe, to one side of the last. Treat a similar piece for the other side in a like manner, paste the edge (using bookbinders' paste or a mixture of glue and paste) for about \$\frac{1}{2}\$ in. up ABC (Fig. 1) and EF, and last that in a similar way, letting the edges overlap so that one edge may adhere to the other up the front and back, putting in a few tacks to keep the edges in place till dry. When thoroughly dry, last on the one layer (Fig. 2) and give the whole a coat of paste, then paste on the cap (Fig. 3), lasting each piece over as for the upper of a shoe, and when this has set the two pieces similar to the first may be put on. When dry, give a coat of plaster-of-Paris and whiting, and when this has set quite hard smooth off with fine sandpaper and paint any colour desired. The lasts could also be made with several layers of brown paper or thin strawboard, which can be pared off with a sharp knife. When finished, the bottom rough edges can be cut off to the bottom of the last, ready for the wood hottom. If a very solid last is nessed, a good method would be to coat the last with thin paper, and enease it with papier-mache; when quite set, rasp or file off any roughness. By this means on, say, a pointed-toed last, any shape could be got, as it would only mean adding a little more papier-mache were needed.

Cleaning Telescope Lenses.—Telescope lenses when Cleaning Telescope Lenses.—Telescope lenses when returned to their fittings after having been removed for cleaning must occupy as nearly as possible their former positions. It would perhaps be wise to clean each lens separately, carefully marking with a lead pencil the edges of the lenses in the objective and the cell, so that when the lenses are returned the lines are guides. The eyepiece lenses that are burnished into their cells present no difficulty. To clean the lenses, first sponge the surfaces with cotton-wool dipped in spirit of wine, then polish with a fine cambric pocket handkerchief. then polish with a fine cambric pocket handkerchief.

Adapting Roll-holder to Pocket Camera.—The simplest plan of employing films with a pocket camera constructed to take plates would be to use cut films; this would not involve the alteration of any portion of the apparatus, the films being merely slipped into the dark slides like plates. The accompanying illustrations show the construction of a roll-holder. Fig. 1 is a plan of the holder, which consists of a box frame with open sides from AA and BB. Along the top and bottom of each side is a groove C, which permits the front part D to be slid in, making the whole light-tight; catches are fixed as at E (Fig. 3). This front (Fig. 2) is like an ordinary pocket dark slide, but has wings or side-pieces D to run into AA and BB, and at F is fixed a sheet of vulcanised fibre with an opening the size of the required picture. The shutter G may be of similar material. Fig. 3 is a perspective view. Attached to the back of the frame is a skeleton block (shown by the double line H, Fig. 1), which serves to keep the two rollers I and J in position; two other rollers, K and K', are fixed, one on each side of the front frame. The roller K is provided with pins L (Fig. 4) in the side; the circumference of this roller being exactly equal to the diameter of the picture, the perforations made by the pins serve as a guide in cutting up the film previous to development. A reference to Fig. 4 shows

stove, specially fitted for the work, should be obtained. To renovate the brass part, it must be taken to pieces, and boiled for about twenty minutes in a strong solution of causatic soda to destroy any of the old lacquer; then, when dry, dip in nitric acid to produce a bright colour, and prepare for lacquering. The parts must be gently warmed, and the surface thoroughly covered with a layer of lacquer by a camel-hair brush, great care being exercised that the surface is not gone over twice to streak it. Leave the article on the stove to dry, and when all is finished, put it together and screw up. Of course, any coloured enamel might be used instead of black, as the procedure is the same for all colours.

Renovating Veneer on Piano.—In a piano left in a damp place give may perish and veneer buckle up. In such places, work thin hot freshly made glue underneath by means of a thin bladed table-knife which has been warmed by first dipping in hot water; then press the veneer well home again by means of a warm flat-iron. Oracks, fissures, or broken portions may be made good by a mixture of shellac and resin melted in equal portions, and with a trace of dry pigment added to make the preparation match the colour of the wood. It can be melted in



Adapting Roll-holder to Pocket Camera.

that this roller terminates in a pinion P, having five teeth, which engage with a cog-wheel X having thirty teeth. The cog-wheel is marked with numbers, so that the number of exposed films may be easily read off. The cog-wheel is loosely fixed with a screw into the framework. Fig. 5 shows the key that turns the roller carrying off the film, which drops through the top, the part M coming flush with the surface of the frame. The catch N (Fig. 1) is then turned over M, and holds it in position; whilst the piece of watch spring 8 screwed into the side hites into M, and prevents the key being turned the wrong way.

Renovating Bedsteads.—For renovating bedsteads where conveniences for enamelling or japanning goods are few, it would no doubt pay to lay down a japanning plant in a fairly large well-lighted workshop, with gas laid on for heating the drying and lacquering stoves. Double-cased steel stoves are more economical when continuously used, owing to the saving of the heat by radiation; they will heat up to 500°F. In a short time, and this heat is very easily maintained and regulated. The whole apparatus complete with straight thermometer, and can easily be taken to pieces. Thoroughly clean the parts to be enamelled by emery hobs, sandpaper, or emery-cloth. Then give the surface a thin coating of tar spirit by rubbing over with a rag, drying off for fifteen or twenty minutes at 350°F. to 400°F, in the stove. Next, the enamel must be spread very evenly over the work by a camel-hair brush, and stoved at 250°F. to 300°F. A second coat may now be given, following the same procedure. Lastly, apply with a brush a better black enamel, and afterwards stove at 350°F. to 380°F. The article is now ready for polishing. This is done by well rubbing with cloth or felt; using finely powdered pumice-stone or tripoli. When the operation is nearly finished, rub on a little oil, and when the article is sufficiently bright, rub with oil alone to remove any dust that may have settled on it. Dry off with a soft cotton or silk duster to remove any dust, grit, etc. A small lacquering

a ladle or tin, and the mixture may be pressed where required by a chip of wood. Clean off level, wipe over with raw linseed oil, and repolish.

with raw linseed oil, and repolish.

Refixing Drumhead.—Here is explained how to refix a drumhead which has got on the cross. First of all, the head must be removed from the flesh hoop by scaking in cold water till found quite pliable. Previous to removing the head, observe how it was lapped round the hoop, as a guide for getting it on again. Before refixing, the head should be cleaned with a flamel and a little soap. Whilst still wet, place it face downwards on a cleau table or bench, and lay on the flesh hoop so that the margin for lapping is equal all round. Divide the circumference into four, marking the points with a pencil dot; and commence the lapping at one of the points by tucking in the skin as it was before, and do the same with the opposite point. When these four points are worked in, again take the midway points, and proceed as before, never working two points on one side, but always taking the opposite point, and so on till the skin is on all round. Care must be taken that the head shall lie without wrinkles, or shall not draw the hoop out of shape. For the first few laps the fingers can be used, but afterwards a curved flate-ended tool, similar in shape to the handle of a pair of pliers, but much more curved at the end, will be found necessary. After lapping, and whilst still damp, place the head in position on the shell of the drum, fix the hoops, and only moderately tighten by the braces, and when dry tighten to the required pitch. The services of an assistant whilst fixing the skin will be invaluable.

Dinged Brickwork.—There are two kinds of dinging; one is axing old bricks to look like new, and the other is rubbing over the walls, new or old, with a piece of coloured brick in order to give the same general tint throughout. The latter method is generally adopted before tuck pointing in order to hide the original mortar.

Rendering Bone and Horn Transparent.—The opacity of hone is due to the presence of phosphate of lime, which it contains to the extent of 60 or 70 per cent. The lime can be removed by treating with dilute hydrochloric acid, but all that is left is the gelatine, the hone being destroyed; hence, for all practical purposes the opacity of bone cannot be removed. There is no method of removing the opacity from white horn, but treating with hydrochloric acid might be tried.

Convertible Mailcart.—Fig. 1 shows a convertible mailcart with a bassinette shaped body, Fig. 2 illustrating the panels A, rockers, and seats. In Fig. 3 D is a hinge, Fig. 4 heing a side view of the plate G and showing a slot E, which fixes the handles in any position by a

The back part of the body is lft. 4in, wide on the bottom, and lft. 5in, outside the top of the panel. The handles H (Figs. 1 and 3) are lin square, and are screwed on to the rockers from the inside. The wheels are 2ft. lin. and lft. high.

Restoring Colour of a Mahogany Table.—The dirt and old furniture paste can be removed from a mahogany table by well ruhbing with paraffin or henzoline. The scratches, if deep, will require to be drawn up by pressing a strip of warm iron along the r track, first wetting the place with cold water; or, better still, place a wet piece of rag over the bruise and press the hot iron along, the steam thus generated often drawing up the bruised surface level. If this fails, however, it may be necessary to scrape the surrounding surface till it is level with the damaged portion, and if the scratches are not deep it will only is removed; do this with No. 1 glass paper, first wiping over its face with liusech

3.0" 1.10 Fig. 2 С C D Fig. 3 G FIG. I Convertible Mailcart, 0

bolt similar to F (Fig. 3). In making the body, work to a full-size drawing of the complete mailcart, and order the wheels, axles, springs, and other parts, which can be obtained. If the cart is to be varnished in the wood, American walnut looks well, with white ash mouldings G (Fig. 1), and if it is to be painted white wood would do. The rockers B (Fig. 2) are screwed inside the panels, §in. on, and boxed out on the bottom to take a \$\frac{1}{2}\$ in. on, and boxed out on the bottom to take a \$\frac{1}{2}\$ in. The body panel, front panel, and bottom part and footboard are boxed out \$\frac{1}{2}\$ in. deep, and the seats are convertible into a cot by the use of the centreboard K, Fig. 2. When not used as a cot this is swing over on the back. J. Fig. 2, is a binge, and the front seat can be dropped and the child can sit on the fixed front seat.

FIG. 4

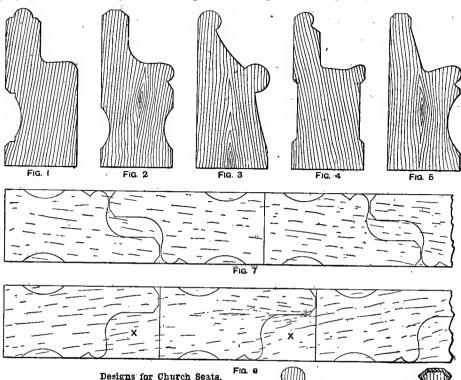
oil, finishing with finer paper. The faded portions will require colouring up, unless the faded polish is removed by sprinkling it with methylated spirit and rubbing whilst still wet with glasspaper. Coloured polish will probably be necessary to get an even colour.

Parchment Paper.—This is made by running finished paper through snlphuric acid slightly diluted with water, and neutralising the excess of acid by an alkaline bath or water. The acid could not be used in the beating engines, and if it were applied to the pulp, the operation would have to be done in an earthenware or lead-lined tank and the pulp thoroughly washed before it was brought on to the felts. Any treatment of the pulp would, however, not have the same effect as that produced on the paper, the action of the acid causing the solution of a certain portion of the surface cellulose and its deposition on the exterior of the paper as a continuous and, to a certain extent, impervious film.

Designs for Church Seats.—In most places of worship the old-fashioned box seat is superseded by the open seat. These seats are, as a rule, made of pitchpine. As pitchpine makes a very cold seat, the seat-board may with advantage be of yellow pine. Figs. 1 to 6 show designs of ends suitable for such seats. The height of the seat-ends varies a little, but is usually about 3ft. 3in., the width being 18in., the thickness 1½in., and the height 2ft. 2in. at the arm level. When a number of ends are required, good clean planks, 18in. by 1½in., are selected. A pattern lined round with lead pencil, after which the ends are cut to line usually with a band-saw. If the proper method is not adopted when lining these

glasspaper. If the instrument is inlaid with pearl and black around the soundhole, this portion may be similarly treated. If, however, it is inlaid with celluloid in the form of a shield, care must be taken that the polish is not removed with the glasspaper. The wood can also be rendered whiter if, when glasspaper is being used, the surface is rubbed with chalk or whiting so that the operation of rubbing may at the same time press some of the chalk or whiting into the wood pores; such an effect is not very permanent, of course.

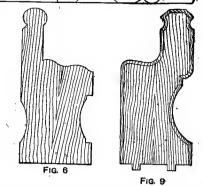
Colouring Illumination Lamps. - For colouring plain illumination lamps, first cleanse them with a strong solution of potash, well rinse in clean water,



ends, much timber will be wasted. Fig. 7 shows a correct method of lining. From Fig. 8, which shows a wrong method, it will be noticed that in a plank long enough for four or more ends, for every four ends lined there will be a waste of about two-thirds the length of an end, and for every six ends, waste equal to one end in the length of the plank. In the figure, X denotes waste. Fig. 9 shows a prepared seat-end, which is chamfered. If the band-sawing has been done to line with a saw in good condition, very little cleaning up will be required after the chamfer has been made. The tenons at the bottom of the seat-ends fit snugly into mortises made in the floor.

Purifying Sweet Oil.—The simplest method of cleaning sweet oil that is very dirty will be to heat the oil to about 300°F, and run it through a very fine strainer or a piece of muslin. It should then be placed aside for about fourteen days, when the clear top oil may be ladled off. There are several other methods of cleaning the oil, but they would require costly apparatus. If the oil is required very pale or what is known as refined, the cheapest method will be to send it to an oil refinery and have it chemically treated. The process described above would sufficiently refine the oil for ordinary purposes, lubricating, etc.

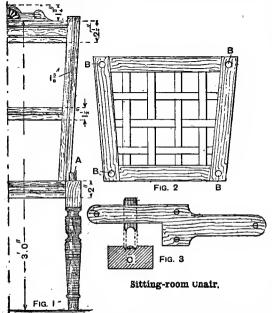
Cleaning Soundboard of Unpolished Mandoline.— The usual method of cleaning the soundboard of an unpolished mandoline is to remove the upper surface by means of a cabinetmaker's steel scraper and finish off with two grades of glasspaper. If a scraper is not at hand, cold water and pumicestone scap or Monkey brand scap is advised; this should remove the dirt, When the surface is quite dry, smooth down with No. 0



thoroughly dry, and place in a warm room for a few hours before colouring so as to warm them sufficiently to prevent chilling. Obtain small quantities of Crane's cold lacquer of the colours required, and either dip the lamps and drain or lay the lacquer on with a camel-hair brush, the latter method being the better if only a few dozen lamps are to be coloured. Then hang them up to dry in a warm room. Common tumblers will answer the purpose of the lamps. They only need lacquering two-thirds up from the bottom, and about a tablespoonful of water should be put in when using to prevent damage to the tumbler. The lacquer cau be removed with strong soda water. Price's special bucket lamp candles may be used on account of their cleanliness. Guttering candles will make the lamps very messy.

Screen Making.—The only method of hanging screens without metallic hinges is to use linen webbing, as in a clothes-horse; or for small pulp-board fire-screens a piece of tough linen, glued lengthways of the join, will suffice. To cover screens properly, practice is necessary. Heesians, canvas, and flax sheatings require well damping before mounting; leather cloths and other enamel-faced goods must be well warmed to prevent cracking. Always commence tacking in the centre, and work to the corners. Any wrinkles in hessians, canvas, and flax sheetings can generally be shrunk out by damping the back and ironing with a hot smoothing-iron; this will not apply to leather cloths, for which there is no remedy. there is no remedy.

Sitting-room Chair.—Fig. 1 shows in part elevation a form of chair known as a ladder-back. The joints of the chair should be made with stub-tenons and mortises. The back is framed up to 3 ft. high, 1 ft. 6 in. wide at the top, and 1 ft. 2½ in. at the bottom. The front is ft. 4in. high by 1 ft. 6 in. wide over all, the total width of the seat from the front to the back being 1 ft. 4 in. A loose seat (see Fig. 2) is framed from 2 in. by ½ in. pine, and webbed on the top; the holes B fit on to

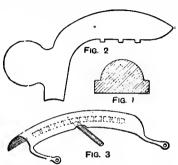


tenons A (Fig. 1) in the top of the knee and prevent the seat moving. In making, the back would be framed up complete, then the front, and the two parts connected by the side rails, the seat frame being made last. Beech wood is excellent for chairs, being very clean and bright in grain, but is more expensive than birch; the latter wood is used in immense quantities for chair making. In the shope the beading would be done on a spindle machine; a hand home-made tool for beading is shown in Fig. 3, being simply two pieces of hardwood screwed together, the cutter heing a thin piece of steel filed to shape and placed between the two pieces of wood; the fence keeps the cutter in a true working line. A profile of the bead is shown at C (Fig. 3). Shopmade handbeadere with iron stocks can be purchased fairly cheaply.

Enlarging Negative by Expansion.—Below is explained how to enlarge a negative by expanding the film. It is necessary in the first place to make up a 5-per-cent. solution of hydrofluoric acid, this is disagreeable stuff to have about, so that a 10-per-cent. solution of hydrochloric acid, which, however, is uncertain in its action, may be used Instead. Citric acid, which is sometimes recommended, is likewise uncertain. Hydrofluoric acid, as well as its solution, owing to its destructive action on glass, must be kept in rubber bottles. This solution forms the stripping bath. Immerse the negative for a few minutes in plain water to ensure even wetting, and then transfer to the stripping bath. After a few moments' immersion the film should begin to show signs of frilling. Now very carefully draw the ball of the first finger lightly across the edge of the

plate; this will effectually loosen the film, and it may then, with the same light motion, be rolled back off the glass. Do not remove the film all from one side, but treat each edge alternately until the film is completely detached. Now carefully lift the glass, together with the film floating upon it, out of the solution, and as carefully lower again into a dish of clean water at least double the size of the film. When the film is helow the surface of the water, the glass may be removed, and its place supplied by a sheet of glass about twice the size, coated with gelatine. If a gelatine solution is not at hand, an unsyposed dry plate, from which the unaltered silver has been fixed out, may be used. When the film has fully expanded (which will depend upon the gelatine, but is generally nearly double the original size) lift the film and glass out together, and stand up to dry. All the operations must be carried out very slowly and carefully, or the film, which, of course, is very thin and is extremely tender when wet, may be broken. Air bubbles, which are liable to get into the solution or between the glass and the film, must be carefully removed. removed

Re-rubbering Pneumatic Tyres.—In re-rubbering pneumatic tyres, first coat both sides of the fabric with solution. Do this by passing the fabric (which is wide enough for the circumference of the tyres) through rolls which are slightly heated, thus ensuring an even coating. Where this cannot be done, thin down the solution with benzoline for the first coat, so that it will soak into the fabric. The second coat should be as thick as treacle, and must be brushed evenly with a stiff brush. The strips are cut on the bias at an angle of about 45°. Two strips are used; these, when some

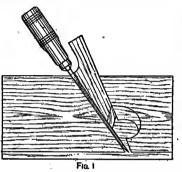


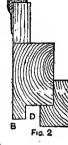
Re-rubbering Pneumatic Tyres.

tioned together, have the threads in the top strip running across the threads in the bottom strip. When the strips have been rolled well together the ends are joined, one end of the top overlapping the bottom, and the other end of the bottom overlapping the top strip. The tyre is made up on a block of the diameter and shape of the tyre. A section of the block is shown in Fig. 1. On each side of the block running round the circumference is a bead or ledge, on which the wires are placed. The fabric is put over the block and the wires over the fabric on to the heads or ledges. The fabric is put straight, solutioned, and turned over the wirss each side and rolled down. When the fabric is dry, it is put over a dummy tyre (an air tube enclosed in a canvas case) and blown up on an ordinary wheel. The wheel is fixed on the bench between two upright strips, slotted to take the spindle passed through the hub. The rubber is put on after being cleaned with benzoline and coated with solution. To get the lines or corrugations straight a guide (Fig. 2) is used. This is made to fit on the edge of the rim and into the corrugations. After the rubber has been well rolled down the edges are trimmed off and the inside of the tyre is rubbed over with French chalk. When the tyres are of ordinary canvas they can be made without the block. If the tyre is to be 3 in. wide, cut the canvas 8 in. wide. Solution one side only. With blue lead draw lines 3\frac{1}{2} in. apart and 2\frac{1}{2} in. from each edge. On these lines the canvas will be folded over the wires. The canvas will overlap line, giving three thicknesses for the tread. Solution and roll down the overlapping portion, and colution on this side for the rubber. The canvas can then be blown up on a wheel. A handy tool for stripping off old rubbers can be made as follows. Bend a piece of sheet iron, about No. 12 gauge, as shown in Fig. 3. A gas tube is fixed under the plate with small holes drilled in it at intervals; this is connected to the gas bracket by a rubber tube. The tyr

Selecting and Turning Watch Cylinder.—In selecting a watch cylinder one must be obtained that is longer than the old one now discarded, and its diameter must be such that the wheel teeth go inside it and have a little shake; also, the cylinder must go between two wheel teeth with a little shake. The freedom of a tooth in the cylinder is the "inside shake"; the freedom of the cylinder between two teeth is the "outside shake." These should be approximately equal. To measure the height of the passage, remove the under chariot, and in its place screw a thin piece of brass having a hole, where the cylinder comes, half the size of the cylinder body. Turn the lower part of the cylinder away until, when it stands on this brass piece, the passage is correct. Then turn the bottom pivot. When turned and rounded up and stood in its jewel hole, sight the height of the balance seat just above the 'scape cock level. The total height of the cylinder is measured over the outsides of the jewel holes (with endstones removed) with a douzieme gauge. For further particulars of cylinder turning, see Series II, p. 232.

Home-made Plough Plane.—The drawings show a very handy form of plough plane that can be easily made. The etock may be of any wood, but hard wood for preference, the lower part being rebated so as to leave a projection a little smaller than the plough iron, as shown at B (Figs. 2 and 3), or, as is shown in Fig. 1, a chisel will answer the purpose; then by making a wedge-shaped slot, and gouging a hole out as illustrated for the escape of shavings, a wedge A (Fig. 3) can be made to the required shape; this will fasten the chisel into the stock. The





Home-made Plough Plane.

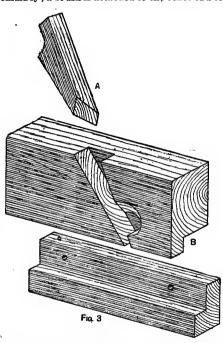
fence (Figs. 2 and 3) is made of another piece of hard wood, nence (rigs. 2and 3) is made of another piece of nara wood, which is rebated so as to leave the required distance for working from the side of the material (maixed D, Fig. 2). It can be secured to the stock by a couple of screws. The disadvantage of this plane is that the fence would require to have a deeper or shallower rebate for each new job, but the alterations could be made without much trouble.

Hardening Gold and Silver Wire.—Gold and silver are hardened by compression, and a suitable way of applying this is by drawing the wire through a draw plate, and reducing its size a little by burnishing it with a steel burnisher and heavy pressure (if the wire is very thin), by twisting it, or by hammering. The method employed depends entirely on the work in hand; thus, a brooch pin that has been soldered at the joint is generally given a twist, a scarf pin soldered in the centre is hammered and burnished, and so on, using the most readily applied method. readily applied method.

Testing Milk.—The analysis of a sample of milk is not a simple matter—in fact, it can be done only by one experienced in the work. It is, however, possible to test milk by simple methods to determine whether it is grossly adulterated or not. To do this it will be necessary to procure a hydrometer and a cream tube, and the simplest form of hydrometer consists of a bulb of glass with also a glass stem; it is loaded with mercury or shot, and the stem is graduated. For examining milk the kind known as a "urineometer" should be procured. If placed in a tube of genuine milk, the hydrometer will sink to the mark 1030 to 1032; in watered milk to a mark below 1039; and in skimmed milk it will sink to 1032 to 1035. The cream tube consists of a glass tube about 6 in. long and 1 in. in diameter, with several graduations near the open end; if the tube is filled to the upper mark and left to stand overnight, the cream will have risen in the morning and may be read off. If genuine milk, 8 to 12 or even more per cent. of cream will have risen; if skimmed milk, less than 8. As a rule, each

division on the scale represents 1 per cent. of cream. It is necessary to use some circumspection in judging the results of these simple tests, because a milk with plenty of cream has a low gravity—i.e. a milk with 12 or 14 per cent. of cream may register only 1028 or 1029 on the hydrometer. Water can be removed from milk only by evaporation, and as for other impurities, with the exception of the occasional addition of preservatives, there are none; preservatives cannot be removed from milk

Chimney Sweeping.—Personal experience is better than any description, and a person requiring an insight into the work should be present when a chimney is swept in the house he occupies. The brush is usually put up the chimney and length after length of the rod screwed on as the brush is pushed up. A cloth is fastened in front of the fireplace if the grate is in a living-room, the rod passing through a hole in the cloth. Chimneye that cannot be swept by rods are cleansed by another arrangement. A ball attached to a cord is dropped down the chimney; a brush is attached to the other end of the



cord, and the sweep, standing at the fireplace, seizes the cord and drawsthe brush downwards. Awkwardly constructed chimneys are provided with external soot-doors through which the rods or the ball can be inserted. Huge farmhouse chimneys are commonly cleaned with a holly bush, which is drawn up and down the chimney as often as required. Tools can generally be obtained from plumbers or from builders' merchants. Soot generally finds a ready market among gardeners, farmers, etc., who use it on the land.

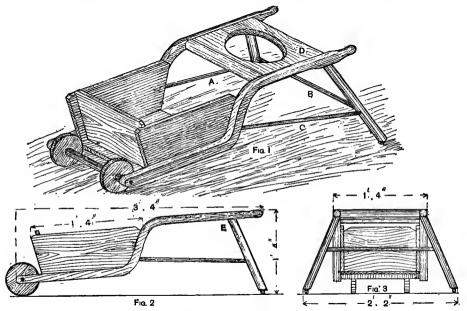
Bright Silver-plating.—To get a bright deposit from ordinary silver-plating solution, put 1 qt. of an old silver solution into a 2 gal. Winchester bottle. Add to this 2 fluid ounces of carbon bisulphide, and shake well together; then fill up the bottle with a strong solution of potassium cyanide. Keep in a cool dark place. Add a small quantity of this to the ordinary plating bath, as required, well stirring the whole each time. This should only be used for special work, and in an old solution, as it ruins the bath for all subsequent ordinary silverplating. A chocolate colour on the anode denotes a deficiency in free cyanide of potassium. The remedy is to add cyanide until the anode works clean.

Boot Dubbing.—For a good dubbing boil together 21b. of black resiu, 11b. of tallow, and 1 gal. of crude or train oil. Another recipe consists of 1 gal. of boiled linseed oil, 41b. of mutton suct, 31b. of yellow beeswax, and 21b. of common resin; melt all the ingredients together. Warm the leather previous to well rubbing in the dubbing. The latter recipe will render shoes waterproof, and can be applied to soles as well as uppers.

Sanded and Painted Wood.—In the case of posts which are to he painted and then coated with fine sand, the process of accomplishing this is as follows. Paint the posts in the ordinary manner, and while the paint is still wet throw handfuls of clean, sharp, dry sand at the posts until the whole of the paint is covered with sand. The sand should first be dried in an oven or over a stove. If the desired effect is not produced by the first coat of sand, a second coat of paint may be applied over the sand after the first coat has properly dried, and then followed with a second application of sand.

Child's Combined Running Stool and Barrow.— The combined running atool and wheelbarrow illustrated by Fig. 1 may be need for teaching a young child to walk. The leading dimensions are figured on the side and end elevations, Figs. 2 and 3, whilst the following are particulars of the construction. The shafts and handles are 1½ in. square, the legs 1½ in. diameter, and the rails A, B, and C (Fig. 1) ¾ in. in diameter; they should be made of ash, the body support D, ¾ in. thick finished, being made of any hard wood. The edges of the hole should be rounded off, and the ends of the support fit into grooves made in the a book is held well up above the head and looked up at, the sides of the book will appear to run together towards the top. Bearing in mind, however, that the size of the object is governed also by the distance the rays travel before reaching the focussing screen, the necessary correction can be made by swinging in the back of the camera at the top, so as to bring the plate vertical or parallel with the object. Information on the use of the swing-back adjustment is given in Series I., p. 338.

Acetylene Generator for Optical Lantern.—In using an acetylene generator with an optical lantern the danger to be guarded against most is that of allowing the gas to escape where there is a naked light, or of bringing a light to the place. It must be borne in mind that, prior to the generator being charged, it is filled with air, and therefore, when the gas is first made, the apparatus becomes charged with mixed gas and air, which is explosive. A fair proportion of the first gas that makes the holder fill should be discharged into the open air to waste. The next thing is to practise charging the apparatus, so that it will not make too much gas at the start (it should not do so afterwards). If too much is made, it will blow out through the water-seal



Child's Combined Running Stool and Barrow.

handles, the parts being screwed together. Any kind of wood will be suitable for the barrow, even deal; the bottom end and sides are all \(^\frac{1}{2}\) in. thick, and the last are 8in. wide. The wheels (\(^\frac{1}{2}\) in. by 6in.) and the spindle (\(^\frac{1}{2}\) in. square) are made of hard wood. The most snitable joint between the legs and handles at E (Fig. 2) will be the morties and tenon, and the three rails A, B, and C fit holes-bored in the legs and shafts. A groove formed in each of the sides receives the front, and ordinary eastors can be used for the hottom of the legs, but those of the ball pattern will be more snitable, as they readily move in any direction. Having cut out the spindle, this being of a square section so that the wheels can be fitted on to it better, its ends can be connected to the shafts by means of a couple of 4-in. round-headed screws, these of course working freely in the holes of the shafts, but fitting tightly into the ends of the spindle. All the parts that come in contact with the child's hands or body are rounded.

Buildings in Photograph out of Perpendicular.—
If two parallel lines (or towers) are photographed when placed at different distances from the camera, it will be found that the lines are at different distances from each other on the focussing screen, the space between the lines being regulated by the distance behind the lens that the rays have to travel, which distance is directly proportional to the distance between the lens and the object. By a natural law of perspective, therefore, if an object is above the line of sight, the rays of light have farther to travel, and the object looks smaller, or the parallel lines come closer together. If

into the room and will smell. If there is risk of this, the apparatus should be kept about 15 ft. from the nearest light (horizontal distance). It is probable that at the worst the generator would not discharge more than \(\frac{1}{2} \) ft. of gas per hour in this manner, and this volume would be dispersed and non-explosive before it reached a light 15 ft. away. But the escape will not occur if the working of the generator is mastered.

Bookbinders' Varnish.—Ordinary shellac varnish is unite good enough for all purposes for which the bookbinder uses varnish. To make it, put a pennyworth of shellac into a hottle, and pour over it 1 pt. of methylated spirit of wine (both to be obtained from the druggist), and cork well and shake occasionally; the shellac will soon dissolve. It may be strained before use into another bottle. If it is too thin, add more lac; if too thick, thin with spirit. There is nothing to be gained by using a high-priced varnish, or one with a number of different gums or lacs, for the object of varnishing is to give certain will do as well as any other. The following recipe is supposed to be the best known. Put into a vessel 6 oz. of mastic in drops, 3 oz. of sandarach finely powdered, 4 oz. of coarsely broken glass, and 32 oz. (1½ pt.) of spirit of wine; place the vessel npon strawin another vessel filled with cold water, put it on the fire and let it boil, stirring with a stick. When the whole appears well mixed, put in 3 oz. of turpentine and boil for another half-hour, then take it off the fire and str until it cools. Next day filter it through fine cotton, and cork well up in a bottle.

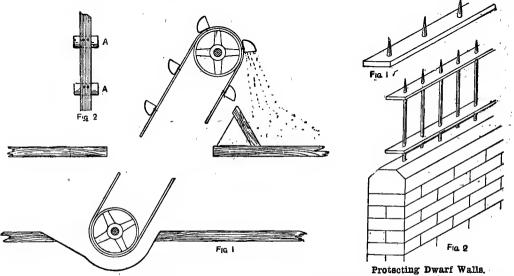
Naphtha Varnisb.—Shellac will readily dissolve in wood naphtha, but the solution does not give a very good varnish. Other gums are generally added to impart brightness and elasticity, and offtimes resin, which gives brightness, is added in excessive quantities because it is cheap. If the varnish is to be used for a quick finish of woodwork the following recipe will be suitable: Wood naphtha 1 gal., shellac 2 lb., resin 8 oz., and gum sandarach 8 oz. Crush the gums, and dissolve in a stone or glass jar, frequently etirring to prevent the gums massing together Strain through muslin. Apply with a camel-hair brush. Keep the bottle tightly corked when not in use.

Grain Elevator.—To lift 30 bushels of oats an hour to a height of 9 ft. would require only about 0008 horse-power, or about oue-eighth of what a single man is capable of lifting in the time if someone else fills for him. A builder's rubbish wheel hung overhead with a 2-in. rope and a canvas-lined cane basket suit the case; but, of course, if an elevator is desired, it may be adopted—say a 1½-in. leather belt with block tin cups 3 in. wide, 1½ in. broad, and 1½ in. deep, with flat backs and curved fronts, 6 in. from centre to centre, fixed to a belt with two copper rivets, and working over a 6-in. belt pulley top and bottom with 1-in. shafts. The bottom pulley would

from the surface; the concrete is then laid to the level of the top of the pegs. The pegs are withdrawn after the concrete has set, and the whole surface is then grouted with cement and sand in the proportion of 1½ to 1; the upper surface should then be covered with fine concrete, formed of 1½ parts of sand to 1 part of cement. A floor of this kind, however, is very likely to crack with the heat of the summer, and instead of an upper surface of fine concrete the better plan will be to use best natural asphalt. A curb in concrete or stone should be laid round the edge of the floor so as to retain the water, and a drain provided with a valve should be constructed in order that the water may be drawn off if necessary.

Chocolate-coloured Paint for Exterior Use.—To prepare the priming coat for outside woodwork, mix together 121b. of genuine white-lead, 21b. of black paint, 21b. of patent driers, 1½ pt. of boiled linseed oil, and ½ pt. of turpentine. For the second coat, of chocolate colour, mix together 141b. of Indian red paint, 11b. of black paint, and 21b. of patent driers, and thin down to the required consistency with 1 pt. of boiled oil, ½ pt. of turpentine, and ½ pt. of oak varnish.

Protecting Dwarf Walls.—The only practicable method of making dwarf walls too uncomfortable for idlers to sit upon is to fix on the top of the walls a wrought-



Grain Elevator.

run in a semicircular race of sheet zinc on the ground floor (see Fig. 1), so that the grain could he fed to the cups, about 105 of them carrying a bushel. For 30 bushels an hour, this would mean a belt speed of, say, 30 ft. per minute, which, with 6-in. pulleys, would be about twenty revolutions a minute, but it would work better if it went faster. Fig. 2 shows a back view of the belt with the cups A fixed. If something cheaper is wauted, upholsterers' webbing, and smaller tin cups, running over wooden wheels, could be employed. A good business grain elevator would be required to lift, say, 3,000 bushels an hour to a height of from 60 ft. to 70 ft., and this would require from 6 to 7 horse-power.

Oak Stain.—A simple method of preparing an oak stain is to mix loz. of black japan in lpt. of turpentine; apply one or two costs according to the depth of colour required. Another stain may be made by dissolving 11h. of glue size in lqt. of boiling water, adding a few ounces of dry burnt umber and ochre to meet requirements. Apply hot. Both the above stains should be allowed to dry, and should then be finished off with two coats of hard oak varnish.

Curling Pond.—Below are some hints on constructing a curling pond, which is to be about 50 yd. long by 13 yd. wide. The site should first be made perfisctly level, and a clay subsoil will be a distinct advantage. The site, after it has been levelled, should be covered with rough concrete about 6 in. thick, made in the proportion of 4 parts broken stone, 2 parts crushed stone or sand, and 1 part of best Portland cement. To ensure getting an even thickness of concrete, pegs should be driven into the ground at frequent intervals and allowed to project 6 in.

iron bar, say $2\frac{1}{2}$ in. by $\frac{1}{2}$ in., with spikes at 5-in. centres, as shown in Fig. 1; a more expensive railing, with two horizontal bars, is shown in Fig. 2. Barbed wire, within 6 ft. of a highway, is illegal, and broken bottles are often impracticable.

often impracticable.

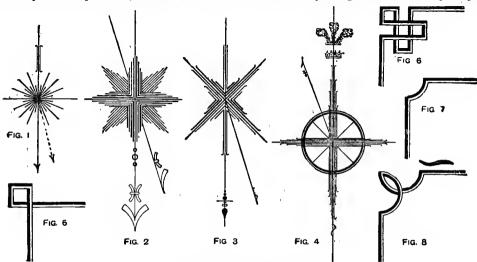
Brunewick Blacks.—The drying agents used in preparing brunswick blacks and black japans are litharge, redlead, and black oxide of manganese; combined with asphaltum and pitch. Isinglass, owing to its insolubility in oils, etc., is unsuitable. Gum kowrie, animi, and copal are used for the finest qualities of black japan, but rarely in the preparation of brunswick blacks. The following are formulæ for brunswick blacks. The following are formulæ for brunswick blacks. (1) For best quality, 81b. asphaltum, 1gal. linseed oil, \$1b. flake litharge, \$1b. black oxide of manganese, and 4gal. American turpentine. (2) For a cheap quality, 41b. common asphaltum, 41b. bone pitch, \$1b. lampblaca, 1 gal. boiled oil, \$1b. litharge, \$1b. black oxide of manganese, and 3gal. turpentine. Resin is sometimes used, but is liable to crack or shell off. The method of preparing these blacks is to place the asphaltum, pitch, and oil in a suitable iron pan and boil for two or three hours. Then sprinkle in steadily the drying agents, litharge, manganese, and lampblack, while constantly stirring, and hoil for an hour or until the mixture turns stringy when worked between the fingers. Allow it to cool down to about 240° F., take well away from the fire, stir in the turpentine, pass through a strainer, and allow it to stand three or four days, when it is ready for use. Recipe No.1 may be employed on all kinds of carriage ironwork, hollow-ware, etc., and recipe No.2 ie much used on all classes of ironwork, stoves, etc. Both of these varnishes dry hard in about three hours, and with a good gloss which is quite durable.

Leeboard for Boat.—A very efficient contrivance to check leeway is the leeboard usually hung from the gunwals at the sides. It should be about one-fifth the length of the boat, and at its broadest part two-thirds its own length, and at its narrowest part one-third its own length, and at its narrowest part one-third its own length. If the board is fixed to an open boat the gunwale should be strengthened at the point of attachment by a piece of timber worked inside at the back of the boat's timbers; for a boat 20 ft. long this should be at least 5 ft. 6 in. long, 6 in. deep, and 1½ in. thick. The board must be pivoted at its narrow end by a ½-in. bolt, and its neck, which passes through the board, should be square, and a square iron plate with a square hole in it should be fitted on each side of the board through which the bolt will pass. The round part of the bolt will pass through the gunwale and streugthening piece. The bolt will be tightened by a thumb nut, and to prevent the latter working into the strengthening piece, it will be best to have an iron plate bent over the topstrake and down on the inside to the strengthening piece. The board should be made of 1-in. English wych (or witch) elm with three through bolte each ½ in. in diameter. This elm is fine-grained, tough, and elastic, and is well suited to the purpose.

Map Corners and North Points.—Figs. 1 to 4 show

Map Corners and North Points.—Figs. 1 to 4 show some north points. Map corners, which may be made

belong and to clean them consecutively. Place the rusted steel and iron parts in a basin filled with paratifn oil. Let them soak for a while, and then rub them free of rust. Brush the chain with rather a hard tooth-brush and examlue each link to see that no material damage has been done. If the links are sound, well and good; if not, a new chain may be required. Similarly with the springs and the pointer. The latter is, of course, of aluminium, and will require gentle handling. When all the parts have been cleaned and dried, rub them over with clean tallow and, reversing operations, fix them again in their respective places. If when removing close observation has been made as to the relative positions of screws and levers, and the pieces are replaced as nearly as possible to their places previous to removal, much time and trouble may be saved in the matter of regulating the instrument. When the instrument has been put together and screwed into its case, it must be tested under an air pump to ascertain whether there is any alteration in its range—that is, in the number of inches indicated on the dial. If this test is unsatisfactory, another dial should be obtained and divided to suit. When this has been divided and engraved, and placed in position, the pointer is attached to the arbor. Then the portion of the scale to which it should point is accertained by reference to the scale of a standard mercurial barometer. By a slight turn of the adjusting screw



Map Corners and North Points.

In either single or double lines, are shown by Figs. 5 to 8. If stencils are used, a stencil leaf may be placed in each corner and joined by straight lines.

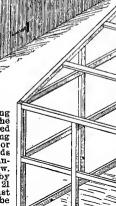
Cleaning Aneroid Barometer.—When taking an aneroid barometer to pieces for the purpose of cleaning, first remove the pointer, which, like the hands of a clock, is merely pressed on its arbor. Then remove the dial. It will now be seen that to the mainspring (which, acting in opposition to the vacuum chamber, gives rise to the variations of the needle in the instrument) is attached the main lever and a system of smaller levers and springs. It will be necessary to remove these next. First release the regulator of the movement, which works between centres supported by the bent ends of a small base-plate. Next detach the fine steel rod which connects the regulator with the main lever. Then unscrew the main lever from the mainspring. The arbor which is attached a fine chain. Release this chain and remove the arbor by unscrewing the centre ends. Now unscrew the projecting arm from the pillar to which it is secured, and remove the thin brass plate which is screwed to the small brass pillars at the end of the projecting arm. By doing this the arbor which carries the hairspring and the chain can be removed. The base-plate of the movement can then be removed. Now take off the knife edge which fastens the mainspring to the upper part of the vacuum chamber, and then unscrew the vacuum chamber from its position on the foundation plate. Having thus taken the whole instrument to pieces and placed the parts separately and systematically to hand, it will be easy to see where they Cleaning Aneroid Barometer.-When taking

connected with the carriage which supports the mainspring, exact agreement is obtained. Finally, the
aneroid must be tested under various pressures with a
standard mercurial barometer. In testing, both instruments are placed in receivers connected by a tube and
stopcock, thus virtually forming one chamber. When
the compartments are simultaneously exhausted of air,
if the scale of the aneroid has been rightly divided and
the instrument works in accord with these divisions,
the pressure in inches indicated will correspond, tenth
for tenth, with the divisions on the mercurial scale as
the mercury falls and rises. Lastly, it must be remembered that, however well the instrument may have stood
all the tests, any form of aneroid will require, occasional
adjustment, which must be done as already directed by
means of the adjusting screw and comparison with a
standard mercurial barometer.

Stripping Films from Photographic Prints.— Ordinary P.O.P. has been squeegeed down and hot water poured on the back of the print till the paper water poured on the back of the print till the paper blistered off, but the results are extremely uncertain and decidedly not worth the trouble. The cheaper and more expeditious method is to use transferrotype paper (sold by Kodak, Ltd.) or Novitas stripping P.O.P. The article that is to receive the picture is coated with gum; then the print (which has been printed very darkly) is placed in warm water together with a waxed sheet of paper. The soluble substratum of the print soon dissolves, and the gelatine film is liberated and may be floated on the waxed sheet, withdrawn, laid down on the prepared support, and smoothed into close contact. Some little trouble may be experienced in pecling if the surface is not flat. The pictures should be coated with copal varnish, and may then be washed when necessary. Blackening Umbrella Cover.—The colour of an umbrella cover may he improved by sponging it first with a decoction made by boiling 60z. of logwood chips in 1 pt. of water, straining and making up to 1 pt., then sponging with a solution consisting of 2 oz. of copperas and 1 pt. of water; finally, after standing a few hours, sponge with clean water and dry while the umbrella is fully stretched open.

Sectional Lean-to Building.—Fig. 1 shows a sectional lean-to building loft. long, 8ft. wide, height at back 9ft. 6in., height at front 6ft. 6in. Fig. 2 shows the complete skeleton framework, the joints of which are all of a simple character, principally halving and lapping. On looking at Fig. 2 it will be seen that the front, ends, roof, and backform independent pieces of framing, to which the

the wire in the fold; close the part and hold it tight down on the table with one hand, and with the other bend, at right augles, the protruding parts of the wire, which should be equal at the top and bottom. When the parts have been arranged in proper sequence, bring the book to the edge of the table and place a heavy weight on it so that the hands may be free. Now place the wooden back close against the back of the book and hend the wires over this. Little notches should be cut in the brass and wood, in which the wires are to lie closely, and a soldering iron run across will keep the wires from coming loose. During this operation, the book can be handled more easily if tied tightly between two boards. Now the book may he glued and put into the case. Cut a strip of strong linen the same length as the book, and 2 in. broader than the wooden back. Glue the wooden back and place the linen on it, allowing lin. over at each side; pull this on tight and rubit down well to ensure it sticking. Now fit the book in the case, put it flat on the table, open the top cover, and place the weight, and with the fingers pull the linen outwards, at the same time rubbing it on the cover so as to draw it tight and make it adhere well. Close the cover down, turn over the book, and repeat the operations on the other side. Now line the iaside of the cover with white or coloured paper, as desired, and cut the lining so as to leave an equal margin all round. If it is found that the book requires cutting to fit the case properly, each part must be cut separately with a knife and traightedge before putting in the wires.



Sectional Lean-to Building.

FIG. 1

boarding (grooved and tongued matchboarding will be most suitable) would be nailed, then the two posts meeting at the angles would he secured together by two or three bolts and nuts or long screws from the inside would do. The door would be hinged with T hinges, and the boards forming the roof covered with felt. The quantities of timber required, will be se follow. For framing, sashes, etc., 300ft run of 3-in. by 2-in; 800 ft. of 3-in. matchboarding; about 21 sq.ft. of glass. If the building be placed against a wall sufficiently high a back would not be required.

Easy Method of Binding Parts of Periodicals.—The method of binding any book in the publishers' covers is simply the ordinary one of sewing, glueing, cutting, etc. But helow is offered a suggestion for a method of joining together, and attaching to the case, numbers or parts of books or periodicals. When the volume is completed the publishers issue a cloth case or portfolio for binding, and for this it is usual to cut the edges of the book, but this may be dispensed with if desired. Place the case down on the table with the inside uppermost, and measure exactly the space of the back, or the hollow, as it is termed. Cut a piece of wood to fit the hollow, leaving \(\frac{1}{2}\) in of the case over at the top and bottom. When making this measurement, if it is found that the book is longer than it must be, cut it down. The wooden back should be cut from stuff about \(\frac{1}{2}\) in thick, and it should be rounded on one side. At the top and bottom of the flat side fit in flush little strips of sheet brass across the breadth. Get now some tinued copper wire, such as is used for electric bell work, but without the covering, and cut up as many pieces as there are parts in the book. The pieces should be about 1\(\frac{1}{2}\) in longer than the book. Straighten 'these pieces, and place one in the hack or fold of each part of the book. To do this, open the part out flat and place

Nickel-plating Glass.—For nickel-plating glass, first give the glass a very thin layer of varnish or wax, then a coat of blacklead well brushed into the previous coat, so as to cover the whole evenly in every part. The glass, thus prepared, must then be suspended by slings of fine copper wire in an electrotyping bath (11b. of copper sulphate and 40z. of sulphuric acid in 1 gal. of rainwater), and copper deposited on the glass from this by electric current from a battery or a platting dynamo until the whole has been perfectly coated with copper. The glass must then he rinsed in water, and transferred at once to the nickel-plating bath, where it receives the requisite coat of nickel. It is not advisable to add bicarbonate of soda or any other foreign salt to the nickel bath. Bronze powder may be used instead of blacklead in preparing the glass for a copper deposit. Other metal powders have also been used for the same purpose with some success.

Fig-2

Parai a

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Polishing Pebbles.—Pebbles may be cut and polished by an amateur with the requisite patience, an old sewing machine serving as the basis of a cutting machine; but in place of the ordinary wheel it would be necessary to put a heavy fly-wheel, say of about 201b. weight and about 10 in. in diameter, with a pulley about 6 in. in diameter attached. On the table should be screwed two wooden blocks with bearings for a 1-in. iron pipe, to which should be attached a pulley about 4 in. in diameter, and two auts for bolting on the cutting and polishing discs. The cutting discs should be of thick copper about 4 in. in diameter, bevelled at the edges, and fed with emery and water. The polishing discs will be one of copper (about 6 in. in diameter) covered with fine sand and water, one of wood covered with leather and whiting, and one of wood covered with felt and dry putty powder.

Softening Rearshin Rug.—To render the hearshin

Softening Bearskin Rug.—To render the bearskin supple, sponge it at the back till soft with hot water, then, before the water dries out, well rub the skin with olive oil, and continue rubbing with a little oil for two or three days; this will prevent the skin hardening again. To comb out the matted parts, sponge them with warm water to which a little carbonate of soda has been added; if this does not loosen the dirt, sponge with parafin oil and comb with a coarse comb rubbed with oil. A little oil on the hair will give it a good gloss and finish. it a good gloss and finish,

Tumbling Drum for Cleaning Rusty Metal Articles.—The accompanying illustration shows a tumbling drum suitable for cleaning rusty nails, etc. The apparatus consists of a barrel, with a door in it, which runs eccentrically on a spindle, the spindle being driven either by hand or steam. If driven by hand, a handle can



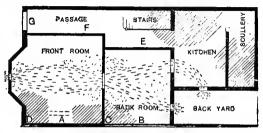
Tumbling Drum for Cleaning Rusty Metal Articles.

be substituted for the pulley. Into the drum is placed some river sand, moistened with dilute sulphuric acid, and then the articles to be cleaned. When the drum is revolved the articles are continuously being shifted, so that every part of them becomes polished.

revolved the articles are continuously being shifted, so that every part of them becomes polished.

Removal of Dry Rot.—Dry rot has appeared in a house, a sketch plan of which is shown by the accompanying illustration. About eight years after building, the boarded floor of the kitchen was very badly affected with dry rot, and it had to be raised, filled in with earth and gravel, and the floor covered with coloured tiles instead of a new boarded floor. Later, the drawing-room floor became badly affected. According to the sketch plan, the house appears to be on the whole fairly well provided with ventilation, the arrangement of ventilators being quite a usual one for houses of this kind. The plan shows a terrace house of the usual how-window, no-basement type. The front room, back room, kitchen, and scullery stand successively to the rear of each other; and are connected under the flooring by air-way openings in the walls, in the usual manner. An external ventilator is fixed under the bow window in front, and air-ways open from the kitchen into the backyard, at the rear; and also from the back room into the backyard. There are three ways in which the inception and the spread of dry rot in wood can positively be prevented. (1) By subjecting the wood to the action of a continuous current of fresh air; (2) by coating or churging the wood with solutions of various mineral salts, etc.; (3) by keeping the wood exposed to very high (over 150' t.) or to very low (below 32° F.) temperatures. The first method is a sufficient and ample protection when effectively carried out; but that efficiency is only to be determined by the success of the particular case. The means generally adopted for putting this preventive method into effect is by various systems of ventilators; but from the differences that exist in the elevation of houses, in their immediate surroundings, and in the nature of the soil upon which the houses are built, obviously the same system of ventilators cannot be equally effective in every case. Under the lower

really wet places; though the fungus cannot stand complete immersion. Now, if to a fungus growing under the floor of a damp house a little air is admitted, the fungus will not only continue to grow but will be benefited. If more ventilation still is allowed, the fungus thrives beyond all reckoning; but by admitting more and more air a stage is presently reached at which the fungus wilts away and dies. At this point effective ventilation has been secured. The explanation of this is that the fungus before it can grow well must have some air, as well as plenty of moisture. (If the place where the fungus grows is also warm, as, for example, in the vicinity of a fireplace, the life and growth couditions will clearly be equal to the best that could be obtained in a forcing house.) But when new supplies of air are admitted so rapidly that the atmosphere under the floor is no longer moist and semi-stagnaut, then the conditions become unfavourable to this low form of life, and the fungus is unable to thrive. First the moisture is withdrawn from the air in which the fungus grows, then the moisture is taken from the timber to which the fungus is attached, and lastly (more important than all) the moisture in the fungus itself is absorbed by the ever-passing current of new air, and the fungus shrinks, becomes shapeless, and dies. Dry timber and the dry-rot fungus therefore cannot exist for long together in the same place. Given damp timber to which a voracious fungus is attached, fresh air plentifully admitted and directed so that it plays on the fungus must of necessity kill the fungus in the end; but the volume of air may be much or little, this factor varying according to the natural humidity and situation of the site under consideration. On the other hand, admitting air that is insufficient in quantity to kill the fungus, only increases the evil. In



Sketch Plan of House.

the house here illustrated, the quantity of air admitted may be sufficient, but the currents are not broken up, as they should be, in order to affect equally all parts of the floor. This breaking up of the current may be accomplished by placing obstructions in suitable positions; dwarf walls, with air-openings alternately in the middle and at opposite ends of the walls, are generally very effective. In the case of this house, which is without dwarf walls, an upright boarded screen resting on the ground lift, away from the opening would break up the current considerably. If fireplaces occupy positions at A and B, then (under the present conditions) the shaded portions are very liable to become affected with dry rot. A ventilator might be placed at D, in the front doul if possible, or else in the side bay of the window, and an air-hole made at C; if there is no riser at the front door that could be taken out and replaced by a ventilator, a small floor grating ventilator should be inserted. front door that could be taken out and replaced by a ventilator, a small floor grating ventilator should be inserted just inside or outside the front door. For additional security air-ways might be made at E and F. As hard floors have now been provided to the scullery and the kitchen, these floors will not require attention. In conclusion, a house should be provided with large ventilators, capable of admitting a considerable volume of air. The current of air should on entry be dispersed and distributed over the whole of the floor area, thus consuring under the floor a similar atmospheric condition to that which exists outside the building; in such circumstances the day not funces cannot live. cumstances the dry rot fungus cannot live.

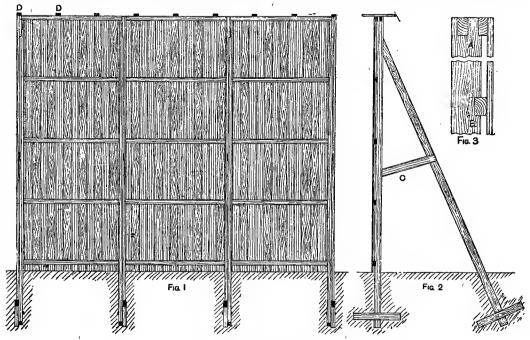
Scented Jelly.—To prepare a scented jelly, soak I oz. of gelatine in 5 oz. of water, and keep in a warm place till dissolved. Melt by gentle heat, stir in a few drops of scent, then pour into a shallow tin mould. When cold, cut into squares. If it is desired to have the squares dry, rub them with powdered starch. If kept very long, these squares will dry; to obviate this, instead of 5 oz. of water use 3 oz. of water and 2 oz. of glycerine.

Filing up Clock Pinions .- Filing up worn rinng up Clock Finnons.—rinng up worn thore pinions makes a very poor job; a narrow wedge-shaped fine-cut file should be used, and the pinion rested on a wood block. When the worn pits have been filed out, the file marks must be removed and the leaves smoothed by oilstone-dust and oil on a wood polisher Renovating Fireman's Leather Helmet.—To renovate a fireman's leather believe which is very much scratched, well-sandpaper the helmet till it is quite smooth and level, then apply a polish composed of 5 lb. of white wax, 5 lb. of hrow us oap, and 50 oz. of cocoanut oil. Mele the wax over the fire, then dissolve the soap therein, cut up small. When homogeneous, stir in black and blue pigments, and finally the cocoanut oil. Stir until all the ingredients are thoroughly incorporated and until the preparation is cold to prevent separation of the wax, then pour out into tins or moulds. Rub a little of the wax on the patent leather, then polish briskly with a clean rag.

Hoarding for Bill Posting.—Fig. 1 shows a back view of a bill posting hoarding 16ft. high and 20ft. wide, properly supported with stays at the back. Fig. 2 is a side view. The main framing is formed of four posts of 5-in. by 3-in. stuff, and the head is of 5-in. by 3-in. stuff, and the head is of 5-in. by 3-in. stuff also. The best plan will be to mortige and tenon these parts together as shown by the section at A (Fig. 3),

deal is the most economical wood, but for temporary purposes common white deal is frequently used. The best preservative for the parts of scantlings that are buried in the ground is a couple of coats of tar. Tar may also be used as a preservative for the upper portion, but if tar is considered unsightly, a couple of coats of good oil colour may be applied.

How to Use Transfers.—Transfers as used by decorators, coach painters, japanners, and wood finishers are generally printed on two kinds of paper; thus bronze names and gilt decorations as used for the name-plates and ornsmentation of cycles and metallic bedsteads are generally printed on a very thin tissue-like paper, while transfers in colours are printed on a much thicker paper, and in many cases on holding them up in strong light the design and colours can be seen clearly defined. High grade goods of foreign manufacture have printed on the back of the paper an outline tracing of the design corresponding with the position of the printed design;

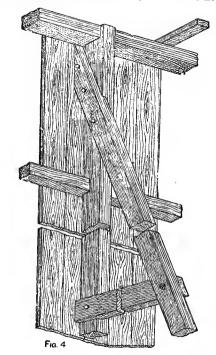


Hoarding for Bill Posting.

where the head overhangs lin. at the front; the reason for this is that the horizontal rails (which are 3 in. by 3in.) and posts are notched together, lin. heing taken out of each. This makes a strong joh, does not materially weaken the posts or rails, and causes lin. of the horizonts! rail to project (see B. Fig. 3). The posts are sunk 3ft. or 4ft. into the ground, and as an additional security crosspieces about 3ft. long should be bolted near the bottom of the posts as shown. The whole will be kept in a vertical position by four braces or stays as shown at Fig. 2; these would be lapped on and bolted at their top ends to the posts. To give further strength and to render the braces more rigid, struts should be provided and fixed by bolts to the post and braces as shown at C (Fig. 2); both these members should be 5 in. by 3in. Crosspieces should be holted to the bottom of each of the braces and sunk 3ft. or 4ft. into the ground. The feet of both the posts and braces should be firmly secured by well ramming the earth around them. If the ground is of a soft or treacherous character, lay a bed of concrete in each hole and fill in and ram concrete well round the feet of the posts, etc.; if the ground is of a firm character, this precaution will be unnecessary. The best material for the face of the hoarding will he £-in. prepared floorboards, secured by 2½-in. or 3in. floor brads; but grooved and tongued floorboards, though a little more expensive, preserve a truer surface. At the top of the hoarding are shown some projecting strips (3in. by liftin.), which are nailed to the head; these strips will prevent the top end of the ladder slipping when the bill-poster is at work. For a permanent hoarding good red

this enables the operator to fix the transfer in position with the minimum of trouble. Where this outline is not printed the paper should be held up in a strong light to enable prominent tally marks to be pencilled on. In most cases the transfers are sold by the printers in sheets only, the number of separate designs on each varying, of course, according to their size. Some transfers do not appear transparent when held up to the light, hut are coated or backed with gold or silver, which in some cases gives the impression that they are metal transfers. This metal backing forms a protective coating to the design, and prevents the colour of the ground interfering with or obscuring the colours of the transfer. As a guide, metal covering is necessary on black or dark grounds, and white covering on light coloured grounds, but no covering is needed on white or light tinted grounds. Transfers in which gold, silver, or pearl form part of the design require no covering as metal forms a component part and comes on last in the printing. As a rule there is an extra charge for transfers that require special or metal backing. Decalcomania transfers, manufactured in Chicago, are of high grade. Their colour designs are issued with a special warning that "all transfers when just completed are fresh and delicate, and the colours at such times, not being thoroughly dry, are easily affected by the cleaning substance. The best precaution is to take as many transfers as are needed for immediate use and place them between a newspaper or catalogue in an oven where the heat is about 110° F. leaving them there from twelve to twenty-four hours, at which time the oil in

the colours will be thoroughly dry." This is of special importance where the designs have been printed in accordance with special requirements, such as name tablets or colour designs, to sult special articles. Stock goods do not require this drying process. A good foundation for a transfer is necessary. If the article is painted or japanned the transfers should be put on after the first coat of varnish is hard, and on polished wood all staining, colouring, and embodying should be done first. Marqueteris transfers, which give a perfect imitation of inlaid woods, should be applied when the pores of the wood are filled with polish, and should afterwards be polished with white or transparent polish; they may be successfully used for decorating japanned pulp ware, polished or varnished wood, oilcloth, leather, glass, wax, or stearin such as candles, indiarubber, and celluloid goods. In fact, any hard clean surface that is non-porous can be so treated. It is not absolutely necessary that all transfers should be coated with varnish or French polished, but in all cases where it can be done such treatment is advised, as it tends to keep the



Hoarding for Bill Posting.

transfers clean, prevents accidental scratching, protects gold decorations from tarnishing, and, in the case of imitation inlaid woods, tends to add depth and solidity. The transfers must be cut from the sheet with a margin of white paper around the design, and tally pencil marks should be put on the back and corresponding marks on the article to be decorated. Place the design, face upwards, on a sheet of newspaper, and with a camelhair brush apply a thin even coat of transfer varnish. Do not cut in the design, but, first stroking out most of the surplus over the edge of the varnish pot. apply the varnish over the whole of the paper. When the varnish has become tacky, pick up the transfers carefully and place them, picture side downwards, where required. Then with a pad of soft rag, press well down, starting from the centre and working towards the edges to drive out all air bubbles. In the case of stiff papers which do not sit well, slightly damp the back with a sponge moistened in clean warm water, then press well down again to force the design against the surface. A rubber roller (squeegee) as used by photographers will be necessary in the case of large designs and if several transfers are being handled. It is essential that the transfers should be in close contact with the surface in every part. Allow them to remain at least half an hour, and if possible longer, as the picture then unites more firmly with the surface. Next with a soft sponge and warm water damp the back of the paper, and press down again, using either the pad or the roller. Then apply water more freely till the transfers are well soaked, lift

a corner, and carefully peel off the paper. Wipe up the surplus wet by gently dabbing with a cleau moist chamois leather, and when perfectly dry the transfer may be varnished or pclished as the case may be. Surrounding some of the designs is found a film of varnish and mucliage, which, when the work has been unduly hurried, is of a whittish appearance. If the article is to be French polished this is of little consequence, sinc what may be lett after sponging with water will usually disappear when wiped over with raw linseed oil before applying the polish. Where an oil varnish or gold size has been used as a fixative and oil varnish or gold size has been used as a fixative and oil varnish will be employed as a finish, the white film may be removed by another sponge saturated with kerosene, benzine, or furpentine mixed with a small amount of water, any surplus left on the face of the design being afterwards wiped off. For articles with a foundation of paint or oil varnish, a first-class quick-drying oil varnish may be used as a fixative, and should be reduced with furpentine to enable it to flow freely and acquire a sufficient "tack" in about fifteen minutes. On french-polished goods any spirit varnish will do, though for gold and pearl inlays a transparent varnish gives the best results and should acquirs the proper tack in a few seconds. On wax or enamel glaze surfaces, best gelatine, dissolved in hot water, or pale gold size may be used as a fixative. For coach-builders' work, the transfers may be affixed by pressing the picture on before a coat of varnish is quite dry. Further information on fixing transfers is given in Series I., pp. 225 and 301, and in Series II., pp. 89, 137, and 202.

Keeping Paint and Enamel Brushes Clean.—
The following is a simple method of keeping paint and enamel brushes clean. For dealing with several brushes that are being frequently used for paint and enamel in various colours, to keep them from touching one another, and yet in compact form, get a jam jar, the size, of course, depending on the number of brushes it is to contain, and procure some scraps of sheet metal, about 3½ in. by 2½ in., zinc for preference, being rusting them into tubes about 2½ in. by 1 in. in diameter. These dimensions, of course, may be altered according to the size of the brushes. Now if these tubes are placed upright in the jar, and as many sprnng in as will hold altogether fairly tight, it will be found that they form cells into which brushes may be placed separately, and without fear of coming into contact with one another, and the jar, if kept nearly filled with water, will effectually preserve and keep clean any brushes that may be placed in it.

if kept nearly filled with water, will effectually preserve and keep clean any brushes that may be placed in it.

Systems of Hot-water Supply Compared.—The case for and against the tank and the cylinder systems respectively of hot-water apparatus may be stated as under. As the cylinder system is the more modern of the two, an idea prevails that the cylinder system was introduced as an improvement on the tank system and with the intention of entirely superseding it. This idea is a wrong one, for each system has its advantages and its faults. In the tank system the hot-water reservoir is above the taps, consequently the failure of the cold supply means that the apparatus is very likely to be emptled of water. But failure of the cold supply is very improbable, and practically impossible, in towns that are served with water from a company's mains, but would not be an infrequent occurrence in country houses in which the water is supplied by a pump. The advantage possessed by the tank system is the satisfactory flow from the taps, the water flowing full and rapidly from all taps, both high and low. In the cylinder system the hot-water reservoir is below all the tap branches and cannot be emptied (except by a special cock), and this arrangement ensures safety should the water supply fail. On this account the cylinder system is nearly always adopted in country residences. The fault of the system is the poor outflow at the taps, particularly the high ones, from which sometimes the water only dribbles, and as the bath tap is usually the highest, a poor outflow there naturally causes considerable annoyance. The best remedy is to make the cold supply pipe of full size and not choked, but even then the outflow at the high taps is seldom satisfactory. In order to meet this difficulty a combination cylinder tank system is growing in favour for country houses, as this combination system possesses the advantages of both and the faults of neither. The heating qualities of the tank and the cylinder system are equal, for as the bo encasing the cylinder with non-conducting material.

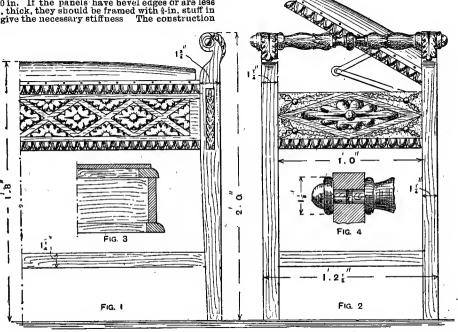
Removing Top from Seltzogene.—Plaster-of-Paris cannot be removed by any method of solution, heuce physical means will be necessary. Fit sheet-lead jaws to a small vice, grip the top of the seltzogene gently with the vice, and twist the bottle slowly. With care the top may be removed, but it must be remembered that the metal is soft.

Aluminium Bronze Paint.—Aluminium bronze paint, which is used for cycle rims and luminous work generally, is prepared by mixing celluloid varnish with aluminium bronze powder. To make a small quantity, place in an earthenware bottle loz. of colouriess celluloid clippings or waste, shreaded fine, and \(\frac{1}{2}\text{tot}\) of acctone; agitate at intervals until the celluloid softens, then add l pt. of amyl acetate and \(\frac{1}{2}\text{tot}\) oz. of castor oil. Mix well together and place aside to repose for several days; the preparation is then ready for mixing with aluminium bronze powder.

Duet Music Ottoman.—A design shown in part elevation in Fig. 1 is a suggestion for a duet music seat with box; carved panels 5 in. wide are to be used, and Louis XV. legs are suggested. The total length of the seat is 30 in. If the panels have bevel edges or are lest han \$ in. thick, they should be framed with \$ in. stuff in order to give the necessary stiffness. The construction

covering of breeze or of sal-ammoniac. The cleansed articles are then dipped in hydrochloric acid, and the surface is also sprinkled with powdered sal-ammoniac then immerse in the molten metal for a short time, and if upon withdrawal the article is not properly coated, sprinkle some more sal-ammoniac upon the uncoated part; immerse again in the molten metal, repeating this operation until the desired coating is obtained.

Use of Drainage Level.—To use a drainage level, set up the tripod and open the legs to a convenient distance apart for stability, screw the level on to the top, and point in the direction required, say to read the height on a staff held at a bauch mark; then tilt the level until the bubble is in the centre, and take the reading. Then shift the staff to the ooint where a comparative height is required, turn the level in that direction, and again adjust the bubble and take the reading. The difference between the two readings will be the difference in level between the two points. The ball and socket joint should be, provided with a clamping screw in order to hold the spirit-level when adjusted, as other



Duet Music Ottoman.

will be understood on reference to Fig. 3, which is a section through the carcase. The underframing will add greatly to the strength of the legs. Fig. 4 shows how the handles and tips are secured to the scroll heads. The lid must be hung with not less than three brase butts and a rule joint at each end (see Fig. 2). Oak is entirely misnitable for Louis XV. or cabricole legs. The legs as shown could be further decorated with a narrow bubble ornament from toe to scroll on two sides.

Galvanising Wire.—The plant required for galvanising small articles made of wire would be, first, a cast-iron obling pan about 9 in. deep and of a suitable length and width, with tapering sides and flanged top; an outer shell of brickwork is built up to the height required to carry the pan, a fireplace, fitted with fire-bars, being provided underneath for melting the zinc in the 'pan. At the froat end the fire-box is closed with an iron door, and the opposite end is bricked in, with the exception of the space left for carrying off the burnt gases into a suitably arranged chimney. The iron to be galvanised must be pickled quite clean, and be absolutely free from all scale spots; pickling is done by immersion in warm sulphuric acid, after which the metal is well rinsed in clean water. Prepare a good bath of molten zinc, the temperature being kept well above the actual melting point, and the metal protected from oxidation by a

wise, after frequent use, the joint becomes slack and will not stay in position.

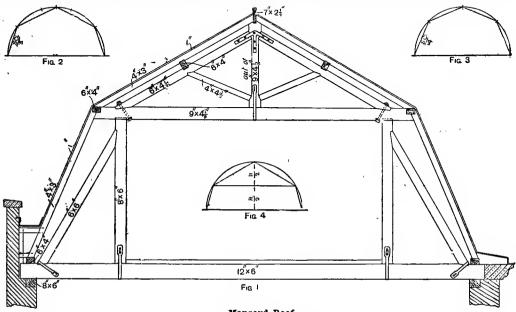
French-polishing Inlaid Table Top.—Below is described a method of polishing an inlaid table top so that the inlaid woods may retain their natural colours. White polish made of bleached shellac (this is obtainable at druggists' stores) should be used. The shellac should be broken up small and spread out on paper in a warm room (say for twenty-four hours), turning the shellac occasionally until it feels quite dry; great heat is not required, as heat causes the gum to mass together again. Dissolve 6 oz. of the lac in 1 pt. of methylated spirit; place the bottle (with a loosely fitting cork) where it can be gradually warmed to blood heat, and the lac will readily dissolve. The table top should be wiped over with raw linseed oil and the polish laid on with a ruhber; a suitable rubber is made with wadding enclosed in a rag covering. Many applications of the polish will be required to produce a level lustrous surface, as no grain filler will be used, and the woods employed for the inlaying vary in the texture or openness of their grain. A little pumice powder sprinkled on the work as the polishing proceeds will greatly assist in driving the polish into the grain, and will also help in grinding the polish level. A transparent polish that may be used instead of the above recipe is sold at some stores.

Turning Watch Fusee Ratchet.—Pick out a fusce ratchet of the right size, and to accertain this place it on the maintaining ratchet and see that its teeth will engage properly with the clicks. Take the fusee and cut off the old plus that fastened the ratchet. Open out the oshre hole of this new ratchet to push tightly on the fusee arbor down to the place. In this position drill the two pinholes well into the fusee brass, and fit and drive in two pins. File them off fush. If a lathe is svailable, fix the fusee in a split chuck and turn it down to correct thickness, and turn out the centre to free the pipe of the maintaining ratchet. If the job has to be done in the turns, a special fusee arbor in which to hold the fusee will be required, and can he obtained at watch-tool shops.

Mansard Roof.—The usual method of constructing a mansard or curb roof is to make it in the form of a king-post truss resting on a queen-post truss (see Fig. 1). The augles to which the sides of the trusses are made are obtained by different methods, as indicated in the

ready for cramping up. The silver should be heated in a small plumbago crucible, the metal being only just melted under a layer of charcoal to prevent admission of air. The mould must be warmed hefore use, and the metal must be carefully poured into the mould. The casting will be very smooth, and if care is exercised no blowholes or air holes will be found.

Lead Pencil Making.—Originally, graphite for lead peucils was cut from blocks with great labour and much loss. The graphite is now finely ground between stones, made into a paste with water, and dried. It is then broken np, passed between rollers, and mixed with the finest clay previously tempered with water. The amount of clay added varies with the hardness required in the pencil. The mixture is placed in a cylinder provided with a pistou, by means of which it is forced through holes of the desired dimensions. The sticks are cut into lengths and laid in grooves in a board till dry. They are next roasted in an oven and, when cold, glued into the woods. 'The reucils are rounded by revolving cutters then glasspapered and varnished.



Mansard Roof,

smaller diagrams; in Fig. 2 the semi-circumference is divided into five equal parts; in Fig. 3 the semi-circumference is divided into four equal parts; and in Fig. 4 the height is divided into two equal parts. In Fig. 1, in order to give clearness to the drawing, the slates are not shown, but the roof boarding is indicated. The eaves may be arranged either with a parapet wall and gutter behind, or with a cornice and gutter. The main object of using a mansard roof is to effect economy of space, or to keep the main walls low whilst forming an additional room in the roof, a chamber being constructed within the trues of the queen-post.

small Silver Caetings.—For casting some candlesticks in silver, the following procedure is suggested. Well vaseline the candlestick to prevent it sticking, then take a slab of metal or slate to form the mould on, or if wood is used fix it on a frame, allowing about 1½-in. margin all round the candlestick. Make a thick cream of Parian cement, beating it up till no air bubbles exist, and run in the mould to a depth of \$in. to I in. Allow it to set, and, when it is sufficiently dry, place the candlestick on it and run on a further quantity of the cement till the pattern is half covered. Of course, the end containing the candle must be plugged with a piece of cork, also the bottom, unless this is desired solid. Let the mould dry for about eight hours, and then well cut in several small dome hollows to act as checks, and vaseline these. Run in more cement till the stick is covered to a depth of I in. or more, and allow this to set, when the two halves will come apart and the stick may be removed. Holes and channels for the pouring must be cut, and pattern cores must be inserted for the hollow of the stick and base, when the mould will he

Dyeing Bone.—Here is a recipe for a good and cheap black for dyeing bone to a depth of γ_{ν} in. or $\frac{1}{2}$ in. First boil the hone in a solution of washing soda to remove grease, then wash in clean water. Prepare two separate baths, one consisting of 2 oz. of logwood chips boiled with 1 qt. of water and strained, the other made up of 1 oz. of sulphate of iron (copperas) in 1 qt. of water. Boil the bones first in the logwood liquor for fifteen minutes, then remove and boil in the sulphate of iron bath for an equal time; remove, dip in warm water, and dry slowly.

Transparent Soap.—A good soap is first made preferably from oils, and is dissolved in hot spirit of wine; the impurities are allowed to settle out, or are filtered off, and the pure transparent soap solution is evaporated to dryness in a closed pan, the spirit being recovered by using a still-head and condenser. The soap is then moulded. The alcohol or spirit of wine is used over and over again, but there is always some lost each time it is evaporated, and this has to be replaced from time to time.

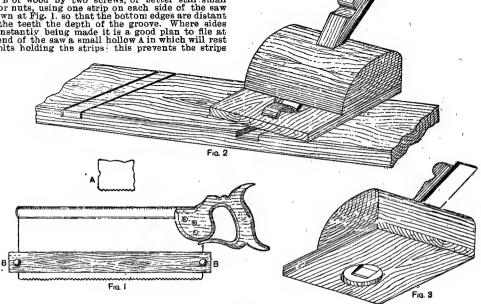
Removing Earthy Smell from Wine Cask.—In the case of an oak wine cask that has contained garden soil for about twelve months, take out the head of the cask, first marking it and the staff opposite so that it may be returned to the cask exactly as it was before. Scrub the cask with hot water and soda, and if any smell remains after this, take off all the hoops except the end one on that end that has the head in, knock off each staff separately, shave the inside, and return the stayes to their places again; also shave the heads and replace in the cask. If the cask is sound, the above method should prove a remedy.

Incubator Regulator.—Metal regulators for use in incubators are not found satisfactory, as the expansion and contraction of metal which is only subjected to 194 F. does not affect them sufficiently to be practicable. The writer recommends spirits of ether and pure alcohol, which boils at 194 F. It is placed between two thin discs of hard brass about 3 in. across, hermetically sealed with a soldering iron, and then placed on the stand in the middle of the machine, a 1-in. wire being passed through the centre of the tank and rested on the centre of the capsule. The upper end of the wire comes under the regulating screw in the damper rod, so that directly the thermometer registers 194 F. the capsule suddenly expands. A metal regulator will not do this, as it expands gradually as the heat increases; consequently heat is lost before the necessary registration is obtained.

heat is lost before the necessary registration is obtained.

Grooving Sides of Step Ladders.—For grooving the sides of step ladders, adopt the following method. After setting out the grooves, the sides should he secured to the bench by two hand screws, or similar means, and the sides of the grooves should beformed by sawing. To facilitate sawing to the right depth, on a saw fix two strips B of wood by two screws, or better still small bolts or nuts, using one strip on each side of the saw as shown at Fig. 1. so that the bottom edges are distant from the teeth the depth of the groove. Where sides are constantly being made it is a good plan to file at each end of the saw a small hollow A in which will rest the holts helding the strips: this prevents the strips

acetic acid. On a shelf inside the pot and above the acid a thin coil of lead is piaced, boards on the pots forming shelves for another layer of pots. Thus astack, containing many tons, may he built up. The stack, when completed, is closed, and the tan ferments, giving off carbonic acid gas, which converts the acetic acid in the pots into vapour. This attacks the blue lead, and converts it into normal lead acetate, finally forming white-lead. This is then crushed, and all blue-lead and other chemical impurities are removed by careful washing and levigating, and the material is dried and finally ground in oil for use as paint. White-lead has excellent covering properties and permanency. It can be mixed with all pigments except those containing sulphur, as ultramarine and cadmium yellow. White-lead or flake white is largely adulterated with barytes, but it may be tested by heating with dilute nitric acid, in which it is completely soluble. Zinc or Chinese whits is prepared from the metal zinc by combustion. The method usually adopted is to throw ingots of zinc into suitable retorts at a white heat. The



Grooving Sides of Step Ladders,

being displaced. Part of the waste in the grooves can next be taken out with a chisel, and, except where knots are present, this can be done at one stroke. Next, the remaining waste may be removed by means of an old woman's tooth or router (Fig. 2). This and the form shown at Fig. 3 can easily be made of any hard wood, and will be found of a very useful kind, as the piece which is screwed on the bottom will make the tool work smoothly.

as the piece which is screwed on the bottom will make the tool work smoothly.

White Pigments.—Permanent white is a pigment which is more commonly known as barytes; it is actiphate of barium, and is obtained both from artificial and natural sources. However, the natural barytes is generally used, being widely distributed in various parts of this and other conntries, and it is known to the lead miners as baryta, spar, or "cawk." To prepare it for use it is subjected to levigation in water, and then bleached, to remove any trace of iron which it usually contains; it is then dried and ground to a paste in oil. Barytes is unaffected by acids, alkalies, or atmospheric influences, by reason of which it derives its name, permanent white. It possesses very little colour or covering power, and is seldom used alone, but is largely used as an adulterant for other pigments. The artificial variety is prepared by precipitation, and is a much finer white than the natural variety, but is rarely used on account of its high price. Flske white or white-lead is made by a variety of processes, such as the Dutch or stack process, the chamber, electric, dry and wet precipitating processes. By the stack process, which is principally used, a layer of spent tan is placed on the floor of a suitable building. A number of earthenware pots are then placed on the tan, in the bottoms of which is placed a small quantity of dilute

zinc volatilises, and is collected in large chambers connected with the retorts. Zinc white is a permanent pigment, and mixes well in both oil and water, and can be mixed with all other pigments without being affected. Its only fault is its bad covering power. For many purposes it is used as a substitute for white-lead on account of its non-poisonous properties. Zinc white is often adulterated with china clay and barytes, but its purity may easily be determined, as it entirely dissolves in dilute acetic, sulphuric, and hydrochloric acids, with which it gives colourless solutions.

Methylated Spirit Soldering Lamp.—A spirit lamp for soldering is best made from a brass tube 8 in. long by lin. in diameter, closed at the bottom. The tube is loosely filled with cotton wick, and spirit is poured on this and finds its way through the wick, which should be pushed down so that it is flush with the open end of the tube. A soldering lamp ought not to be near a reservoir of spirit or it would easily take fire, and the suggestion that a teapot be used as a lamp is out of the question. If a reservoir is desired, it should be of tinplate, closed, and with a tube 2 ft. or 3 ft. long to connect it to the lamp; it should also be supplied with a tap, and fixed at the proper height to give the required flow of spirit.

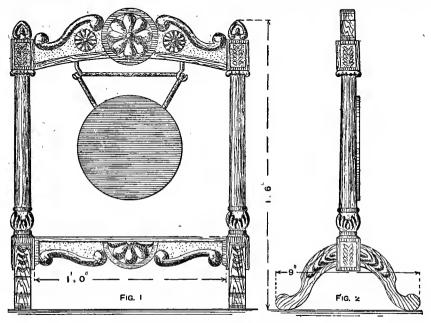
Tarabine—Resolving a powerful liquid drive way he

Terebine.—Terebine, a powerful liquid drier, may be made by mixing together I part of best boiled linseed oil and 3 parts of turpentine, or for very rapid drying, I part of japan gold-size instead of the boiled oil. In reply to a further question, water cannot be mixed properly with petroleum; an emulsion may be made of the two by using a small quantity of yolk of egg.

Painting Ironwork of Mangle.—Here are instructions on painting the ironwork of a large mangle a red colour that will dry hard and glossy. First remove all the old paint by means of a blowlamp, or by a pickling solution made by dissolving ½1b. of caustic soda in ½gal. of warm water. Rnb this over the work repeatedly until the paint softens, when it may easily be removed by means of a scraper or knife. One or two coats of orange-lead mixed in boiled oil should then be given; this adheres firmly to the ironwork, and prevents the formation of rust. After the lead is thoroughly dry, apply a coat of vermilion, vermilionette, madder red, or fast red, ohtained dry and mixed into a paint with copal varnish 16 parts and terehine I part; this will dry hard in about eight hours with a good gloss. Vermilion, madder, and fast red are expensive, but are permanent. Vermilionettes may be purchased at about one-third of the cost of the other colours, but fade after a few months' exposure.

Carved Oak Gong Stand,—Figs. 1 and 2 show a suitable design for a carved oak gong stand. The dimensions are thickness of columns 1\$ in. square, pediment 1 in. thick by 1 ft. long, claws 1\$ in. thick.

The photo-transfer as obtained above is then laid on the zinc, and transferred by means of a press similar to a litho press. The composition, which now includes the drawing, is sponged off and the plate gummed with a broad brush. It is then inked, and of course only the greasy lines of the drawing take the greasy ink. The plate is then thoroughly dried and carefully dusted over by means of a brush with powdered resin, which becomes incorporated with the link. Any particles of powder adhering to the bright part of the plate are rinsed off with water and the plate is then dipped in a 3-per-cent, acid bath. It is then taken out, rinsed with clean water, dried and laid on the hearth till the drawing obtains a gloss, and when cool, the back and also the large blank portions in the front are covered with shellac varnish; this protects the parts covered from the acid. The varnish having dried, the drawing on the zinc is touched up by means of a fine brush or pen and ink. After retonching, the plate is warmed up so that the corrections may unite with the metal. The plate is then shanp etched. This is done by inserting the plate in the acid bath, and the blank metal not covered by shellac is eaten away to the thickness of plate paper. If the lines



Carved Oak Gong Stand.

Zincography.—A convenient method of reproducing a line drawing is to make a zinc block. One of the advantages of using zinc is portability, as the plates are only about in thick and the blocks can be used in an ordinary letterpress machine along with type; or if several copies are required an electrotype can be taken of the block and type together. Plates of Vicelli Montague zinc are used, and the surface as they come from the rolling mill is contaminated with scale and oxide. First is taken a photographic negative, which is afterwards put into a printing frame, and a piece of chemically prepared transfer paper is placed face downwards on it in contact with the film. This transfer paper is exposed to light behind the negative for a time. The paper is then soaked in water to remove the unaltered bichromate in the composition and afterwards stretched over a sheet of glass and very carefully inked over with a velvet roller. The ink adheres to the insolnhle parts of the composition, but leaves the soluble parts untouched and clean. The zinc plate is then prepared for use by scraping off the scale and oxide with a cabinet-maker's scraper, and is subsequently chemically cleaned by smearing a thin layer of whiting over the polished surface and afterwarde rubbing it off with a rag. This frees the plate from grease. The surface is then slightly roughened with pumice-or suake-stone, or by immersing it in a 2-per-cent, acid bath and rapidly withdrawing towash it with pure spring water to prevent oxidisation.

of the drawing are fine, the part eaten away must be less. The plate is then well rinsed with water and allowed to dry on a warm hearth and heated to such a degree as to make the ink run off from the sides of the several lines and points in order to resist the acid. This process is repeated according to circumstances. After the etching, the plate is cooled in a water trough, and oil of turpentine is poured over it and rubbed off again with a soft brush. With a second brush, which has heen dipped in a potash solution, all traces of ink and turps are washed away and the plate is rinsed in spring water. After-etchings are done with a 5-per-cent solution of acid similar to the above. The plates are afterwards mounted on maple-tree wood hy means of pins about ‡in. long.

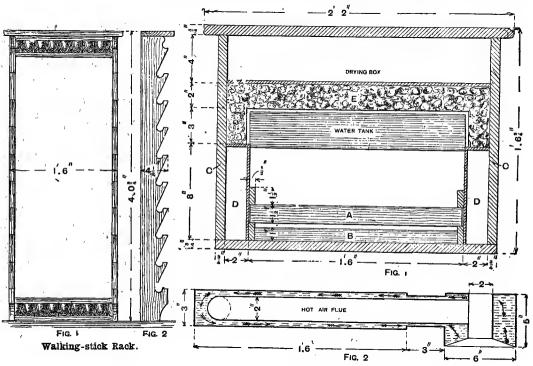
Milk Cans and Churns. — Milk churns are made of strong tinned iron, and milk cans of ordinary tinned plate, whose strength varies with the size of the can. In making by hand stamped lids for small caus, a narrow strip of metal is bent round and fitted loosely to the inside of the top of the can, the ends being joined by a soldered lap seam. An edge just large enough to cover the wired top of the body is then thrown off in the jenny round the top of the rim. An oval of the same shape as the rim is then cut, an allowance for an edge being made so that the top can be edged up and paned down upon the rim. This oval is slightly hollowed before edging up, and after being paned down smoothly on the rim is soldered strongly to it.

Camphorated Oil.—To prepare camphorated oil, warm olive oil, and stir camphor with it till it dissolves. About 1 oz. of camphor to 1 pt. of oil may be used, but if it is wished to sell the article it will be necessary to make it according to the details laid down in the British Pharmacopeia.

Painting Stonework.—For painting stonework stone-colour, first fill up all holes with oil mastic or Roman cement. Then rub or flat down any inequalities with a piece of hard stone. When the stonework is perfectly dry, give it a coat of priming composed of 1½ lb. of geuuine white-lead, 1 lb. of patent driers, and 1½ pt. of boiled linseed oil, tinted to the required depth of colour with yellow ochre paste paint. The next coat should be made from similar material to the priming, but should be thinned down with equal parts of oil and turps. The finishing coat is mixed in 3 parts of boiled oil and 1 part of turpentine. Each coat should be allowed to dry thoroughly hefore applying the next.

Walking-stick Rack.—Figs. 1 and 2 show front and end elevations respectively of a walking-stick rack that is extremely simple in construction. The illustrations are dimensioned, and the sides are housed \(\frac{1}{2}\) in deep into acid emanations from factories and chemical works interfere with the durability of the galvanised zinc coating. Such structures, if painted, will endure much longer than those unpainted, as the protective coat of zinc is also apt to shell off, especially adjoining the parts which have been riveted. These parts, however minute, once they become exposed to the action of the atmosphere, rapidly rust. When painting galvanised iron structures it is customary to give first two coats of red-lead mixed in boiled oil. This forms a hard tenacious coating, on which two coats of a less conspicuous coloured paint may be applied. Care should be taken to apply the paint freely over the joints and rivets so as to prevent the rust forming.

Hundred-egg Incubator.—The following particulars refer to the hundred-egg hot-air incubator which is here illustrated. The drawer A (Fig. 1) should be 18 in. square and 1½ in. deep. The runners for the drawer should be 1½ in. by 18 in. by ½ in., nailed on the bottom of the side of the inner case. The water tray B is 17 in. square and 1 in. deep, thus leaving ½ in. space between the top of the moisture tray and the bottom of the egg drawer. The distance of the bottom of the tank from the eggs is 5 in. The size of the tank is 16 in. square and 3 in.



Hundred egg Incubator.

the top, and screwed from the outside of it. Two lengths of egg and dart moulding are cut and screwed between the sides, one at the top and the other at the bottom, to relieve the appearance.

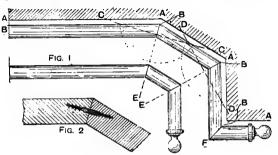
Fusee Matches.—Fusee matches are made from a composition consisting of 9\$ parts of charcoal, 9 parts of salt-petre, 3\$ parts of powdered glass, and 5 parts of gum. The gum is dissolved in water and the other materials are stirred in to form a stiff paste; the heads are made by compressing the material in moulds in which the stems have previously been placed. After drying, the matches are tipped with a composition consisting of 1 part of red phosphorus, 8 parts of chlorate of potash, 4 parts of glue, 1 part of whiting, 4 parts of powdered glass, and 11 parts of water made into a thin cream.

Painting Galvanised Iron Buildings.—Buildings constructed of galvanised iron and situated in country districts, after being painted, should remain in a good state of preservation for at least three years. But structures of this description in any large manufacturing town should be repainted every two years, as the

deep. The outer case C is 23½ in. square, outside measurement, and 18½ in. high, thus leaving a 2-in. (barely) airchamber D all round the inner case, so that the air gets warmed before reaching the eggs. In both inner and outer cases ½ in. holes should be bored, 4 in. apart and 2½ in. below the bottom of the tank. These holes must not be drilled opposite each other; the holes in the inner case must come between the holes in the outer case. For making the framework use ½ in. pine, as it stands the moist atmosphere well. Packing of silicate of cotton should be put in as shown at E. The lamp should be 20 in. long, 4 in. wide, and 1½ in. deep, with a ½-in. "Queen Anne" burner and a chimney made of pieces of talc, put together with paper fasteners, the joints heing made airtight with putty. The water circulator (Fig. 2), tank, and flue pipes are made of places are to be found in the tank, and the heat is copper. Thus water is constantly moving, and no cold places are to be found in the tank, and the heat is uniform. The dimensions of a twenty-egg incubstor are exactly the same as those of a hundred-egg machine, excepting that the tank should be 10 in. equare, the drawer 10 in. square, the inner case 11 in. square, and the outer case 16 in. square; these latter measurements are taken on the inside.

Extracting Tin from Tin.plate.—Tin is dissolved from tin-plate in a boiling solution of caustic soda, and then electrolysing this by a low-voltage electric current; but there are difficulties if a sheet or plate of pure tin is expected as the result of this process, for the dissolved tin would probably oxidise whilst dissolving, and fall to the bottom of the vat in the form of brown mud. This, when washed and dried, might be sold as putty powder or as an oxide of tin. By another process, both tin and iron may be dissolved in sulphuric acid diluted with water, and electrolysed by current from a plating dynamo, using large copper plates as cathodes. The tin scrap may be suspended in wicker baskets, with carbon plates as anodes. The tin will fall in the form of mud, and the iron solution may be evaporated to obtain the iron as green vitriol.

Bay-window Cornice Pole.—The following are instructions on making and measuring cornice poles for bay windows. Fig. 1 shows two patterns of poles: the top pole has six bends with return ends, and the bottom pole four bends only. Carefully measure the architrave of the window, and set it out full size on a floor, table top, or on the back of a length of wall-paper; this line will be AA (Fig. 1). Next get out the working line B B, which will be equidistant all round about 1 in. from A. Now set out the thickness of the pole, which is usually 2½ in., and strike off the lines C C and D D, whose points are at equal distances from the point of the angle; bisect the lines C C and D D to get the lines E, which are the cutting lines for the joints. The lines B B will give the lengths required. Joint F will be a true mitre, and the return end can be any length required. The rings slide in the space between the architrave and the working line,



Bay-window Cornice Pole.

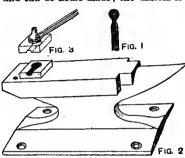
the hollows in the brackets corresponding. For cutting the joiuts use a swivel mitre box; falling this, the trough form of mitre box, which must be set out to cut the same angle as DD, can be used. After the joints are cut, on a piece of cardboard strike a circle of the same diameter as the pole, and cut out to the line; place this on the end of the pole, and pass a bradawl through the centre into the wood; do the same on the opposite face. Now screw ha astout dowel screw for half its length, then screw the opposite joint face up to contact; if not a good fit, chalk the faces, and rasp or file off until the chalk marks all over, then rub the faces with glue and screw up tight. Fig. 2 shows the method of jointing. To allow the rings to slide over the joints, these will require rounding off. The tips are fastened with dowel screws, and can thus be removed when the rings are to be slid on. Special care should be taken to work from the line B, otherwise the pole will not fit. Three brackets will be required, one in the centre of the bay and one at each end

Putting Waltham Watch in Beat.—When the balance is at rest, the ruby pin should be in the lever notch, and the lever should be midway between the banking pins. To ascertain this, wedge the fourth wheel with a broach and let the balance come to rest. If not correct, detach the balance and spring from the balance cock, and turn the collet of the Brequet hairspring round upon the balance staff in the required direction. The collet can be turned safely by inserting into the slit the thin blade of an oiler and using it as a lever.

Setting Wheel Axles.—In setting an axle, the face spokes of the wheel at the bottom are square with the ground line, so as to set the wheel out at the top the double width of the tyre. When measuring the wheels in order to ascertain whether the axle is true, put the wheels on the axle on a level place, with the flap parallel to the ground line, and set the wheels in such a manner that the two face spokes in each wheel line with one another. Then take a 1-in. iron rod, one end of which has been

turned down lin. so as to hook round the spokes and tyres, mark the centre of the wheel in height with a piece of chalk, put marks from the wheel on the tyres front and back, keep the wheels close to the collar, and messure the wheels outside front and back; the front part of the tyres should be \$\frac{1}{2}\text{ in. shorter than the hind part in order to counteract the strain of a heavy load. Then hold the iron close to the centre of the collar of the axle, and across to the edge of the opposite tyre, make a chalk mark on the iron rod, and do the same from the other side; if both tyres come true to the mark, they will be true sideways. Repeat this proceeding from the top of the axle in order to see whether both wheels are alike. No fixed rule can be given as to the allowance that should be made for contraction of tyres, because everything depends on the character and construction of the wheel; \$\frac{1}{2}\text{ in. is sufficient for a Warner wheel, but in the case of hand-made wheels the allowance will depend on the joint that is left in the wheel all around, or the closeness of the felloes on the shoulders of the spokes. No two cases will be exactly alike; the appearance of the wheel is the ouly guide.

Forging Masons' Tools.— In forging a mason's chisel first the mallet head is roughly forged to shape as shown in Fig. 1, and is, when heated, placed in a steel swage on the anvil. which has a matrix of half the head formed in it (see Fig. 2). A corresponding swage containing the other half (Fig. 3) is now used, and struck by the hammerman with the hammer, while the tool is turned round by the smith; about half a dozen blows complete the head, and the body of the tool is afterwards formed to the requisite shape. The swages are of steel and can be home made; the matrix is formed



Forging Masons' Tools.

when heated by driving into it half way the mallet head of an old tool; the swage for the other half is made similarly. In working steel for tools great care should be taken that the steel is not made too hot, or it will be burnt, although in sharpening it should be made as hot as it will stand until finishing, and should theu be hammered until almost black hot, for the reason that it sets the grain finer and gives the tool a better edge; it also makes the steel tougher when hardened and softer when annealed.

Staining Vellum Green.—For colouring white vellum green the following is excellent. Place loz of verdigris (acetate of copper) and loz of white wine vinegar in s bottle near the five for five days, shaking the bottle three or four times each day. Wish the vellum over with pearlash, then colour to the shade required. The skin of vellum is very hard and greasy, and liquids do not readily "take" on the surface, so that in colouring the worker is apt to get a streaky or patchy effect It is best, therefore, to roughen the surface by sprinkling on it pumice-or cuttlefish-powder, and rubbing over lightly with the hand. This must be very carefully done, as there must be no deep scratches. Wash the powder off carefully and proceed with the colouring. The surface is afterwards restored by rubbing paste into it with a bone folder, and when dry coating it with glair. Or the following recine may be tried, Boil 8 parts of cream of tartar and 30 parts of crystallised verdigris in 500 parts of water; when cold pour in 4 parts of nitric acid. Moisten the vellum with a brush or sponge, rubbing firmly so as to roughen the surface, then apply the above liquid. Finish the surface with paste and glaur as described above.

Nalls for Securing Roof Slating.—Wire nails when

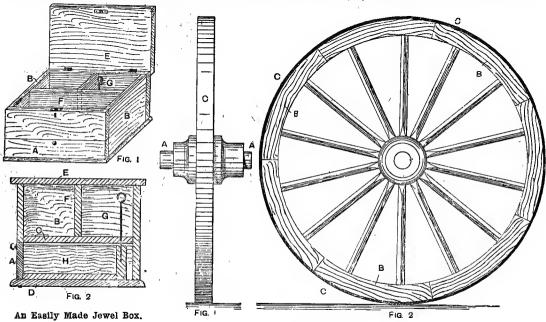
Nails for Securing Roof Slating.—Wire nails when used for slating are very subject to rust. The nails might be galvanised, if the cost is not deterrent; but at least, as a slight protection, the nails might be dipped in boiled oil and dried before use. Composition nails, however, are generally considered to combine the happy medium of cheapness with eliciency

Edging or Grinding Watch Glass in the Turns.— A special arbor, made in two halves, is used to hold watch glasses; the glass is placed between two circular pieces of cork, each of which is provided with a steel centre. The pressure on these keeps all together. An emery buff is applied to the edge of the glass. The arbors can be obtained at watch tool shops.

Easily Made Jewel Box.—The jewel boxhere described could also be used for nicknacks (see Figs. 1 and 2). It is made from \(\frac{1}{2}\)-in. stuff, two sides being \(\frac{3}{2}\) in. long by \(\frac{4}{2}\) in. wide (one of which is cut through to give a piece \(\frac{1}{2}\) in. wide, making the front for a small drawer A), ends \(\frac{5}{2}\) in. by \(\frac{4}{2}\) in. a piece \(\frac{7}{2}\) in. by \(\frac{5}{2}\) in. for a partition to come flush with a piece \(\frac{2}{2}\) in. wide, and two pieces \(\frac{9}{1}\) in. by \(\frac{6}{2}\) in. for the bottom D and lid \(\frac{1}{2}\). The sides and ends are butt-jointed, and the false bottom C is put in; also fix the bottom of the box, which will leave \(\frac{1}{2}\) in. all round and which might be moulded. The top is fitted with two partitions \(\frac{1}{2}\) and \(\frac{1}{2}\), making three compartments. A drawer \(\frac{1}{2}\) is now fitted with the \(\frac{1}{2}\)-in. piece cut from the side for the front as aforesaid, and the back is \(\frac{1}{2}\) in. thick. When the drawer is home, a bradawl is driven through one compartment in the top down into the \(\frac{1}{2}\)-in.

steel melted and cast into ingots. A very good alloy consists of pig-iron containing 6 to 9 per cent. of manganese, generally known as spiegeleisen. About 11 per cent. of the total quantity is first taken and melted. Scrap steel or Bessemer scrap is added till the whole quantity equals three-quarters of a crucible full. The second item is warmed first before placing in the crucible. A special pig iron is used containing about 3½ per cent. manganese, 3per cent. carbon, 4½ per cent. silicon, and ½ per cent. phosphorus. A small additional lot of ferromanganese alloy (say about 1 per cent. of the total weight) is added, the alloy containing from 50 to 60 per cent of manganese. The mixture is well rabbled, and as soon as it is melted casting takes place. It would be quite impossible to melt steel in an ordinary furnace unless there were an exceptional draught with the heat well maintained.

Motor Wagon Wheel.—The box of the wheel of a motor wagon is of gunmetal, and the flanges are shrunk on the boxes, as shown at A (Fig. 1), made in two parts, so that they can take any size of spoke; 2½ in. spokes are generally used. The plates are bolted, as shown in Fig. 2, to the size of the spoke to be used, a



Motor Wagon Wheel.

piece, and a pin made from a piece of iron wire 3 in. long is put into it, thus preventing the drawer being pulled out. When the lid is hinged and a small lock put on, the box and drawer cannot be opened unless broken.

Casting Steel.—As a rule, small steel goods are cast in iron monids usually about 3 in. thick; dry sand moulds as used for iron may also be employed. The great difficulties experienced with steel casting are sbrinking and blowholes. The shrinkage problem has not been fully solved yet, as it is almost impossible to make large, thin, complicated castings of steel. Steel castings frequently shrink upwards of \(\frac{1}{1}\) in to the foot, and the trouble will frequently arise from the hard dry sand mould which it is necessary to use in order to prevent the whits-hot metal destroying the mould. The other difficulty, namely blowholes, although resulting sometimes from the gases disengaged from the metal during the operation of casting, are not always due to that cause, but may be looked for in the high meltiug point of low carhon steel, or in the rapidity with which the metal chills. The blowhole difficulty has been almost entirely overcome by putting a very large rising head on the casting. This is effective in two ways: it carries the sluggish metal from the casting proper, leaving the hot finid metal to fill the mould, and the pressure also tends to force the molten steel into all corners of the mould and thus make it solid. Steel castings should be stripped as soon as poured, and with great care in moulding and high and large risers, good results may be anticipated. A good crucible cast steel consists of ordinary blister

small block of wood being put at top and bottom to keep the plates parallel. The spokes are then put in, a gauge being used to get them all alike. When all the spokes are driven in at equal distances apart at top and bottom, oak wedges are driven in to fill up the spaces between the spokes, and nailed. The flanges are 8 in, in diameter and 1 ft. 4 in. long: the felloes B (Fig. 2) are 2 in. deep by 2 in. wide: the tyres are 2 in. wide by \(\frac{1}{2} \) in. thick, as shown at C (Figs. land 2). In putting together the wheel, the spokes are driven in. tongued down to take the felloes, which, after being cleaned off, are ready for the tyres.

Softening Water.—The temporary hardness of water is due to the presence of calcic and magnesic carbonates, and one method of overcoming it is by boiling, which expels the carbonic acid and precipitates the carbonates. Permanent hardness is due to calcic and magnesic sulphates, which boiling does not affect. Hard water will not dissolve soap, but precipitates it, hence the soap test is now usually employed for determining the hardness of water. Every grain of calcic carbonate or its squiralent in 1 gal, of water constitutes 1 degree of hardness.

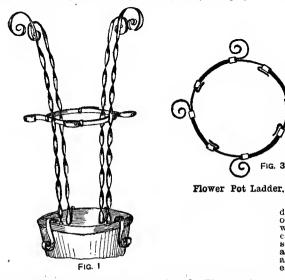
Soap-tableting Machines.—Soap-tableting machines are made either for hand or power work, but the former are more often nsed; they are simply lever presses with reversing springs, and are provided with dies for producing the shape and impression. The soap tablets are cut to shape first before being placed on the die of the machine.

Reatoring Colour of Varnished Oak Gates.—An efficient method of restoying discoloured oak woodwork has not yet been discovered. If, however, the mischief is confined to only a few places, a suitably coloured stain or dye might be used with advantage; but this course is only advised if the patches are of definite outline, and the rest of the woodwork is of a uniform tone not much the worse for wear. On the other hand, if the work is bad all over, owing to the use of originally poor varnish or neglect of revarnishing in time, all traces of existing varnish should be entirely removed with scrapers or by means of a chemical stripper, and the whole of the woodwork brought up to a new surface (using plane, scraper, and glasspaper); then size and varnish in the usual way. The bleached marks do not penetrate deeply into the wood, and a very slight surfacing is all that is required in order to regain the natural colour of the wood. The result also will be more satisfactory than any "faking" of the bad parts could produce. Aldridge's best outside copal oak varnish will be suitable.

Flower Pot Ladder,—For the expanding flower pot ladder (Fig. 1) obtain four 24-in, pieces and four 94-in, pieces of iron. Punch a hole in the centre of each 24-in, piece, and one 6 in, from the end of each 94-in, piece. Having riveted the pieces together, the uprights

by a camel-hair brush. Lay it on from end to end to avoid patchiness, applying several coats if necessary; but remember that each coat makes the varnish so much darker or richer in colour. Though the varnish dries rapidly, one coat should be laid on daily to enable the under coat to harden thoroughly. As the surface thus built up would have an objectionable glarish appearance, it should be allowed to stand at least two days; then the varnish may be dulled down by rubbing with fine grade pumicestone powder and water, the surface being brought up again by rubbing with crocus or rouge and linseed oil, finishing off with the palm of the hand and flour. If only a semi-lustrous finish is desired, it will generally suffice if, after the varnished surface has been dulled, a rag slightly damp with spirit and linseed oil is lightly and briskly rubbed over it in a straight direction.

Obtaining Gelatine and Fat from Bones.—The bones should be chopped or broken as small as possible, then placed in a pan with sufficient water to cover them and boiled for several hours. The water should be made up from time to time as it evaporates. The liquid should then be strained from the bones and allowed to cool, when the fat may be removed as a solid cake from the surface. The liquid containing the gelatine should be evaporated to dryness as quickly as possible in a shallow



dish on a water bath. Gelatine made from bones is not of very good quality, and working on a small scale it will be certain to be turbid, as filtering could not be carried on without pressure. When made on the large scale the bones are heated with water under pressure in a closed boiler; more gelatine is obtained in this way, and the solution is filtered either by using the pressure exerted by a column of the liquid or by filter presses.

Fig. 2

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can be curled or left plain as preferred. The running joints must be left so as to move with a little pull. In turning up the end to fit on the pot, leave at least I in inside the pot; then turn down. The extreme end can be turned with a scroll or left with a hook. In working these designs, leave the ends of strips round to soften the effect. Fig. 2 is a plan of the centre ring, open, while Fig. 3 shows it closed.

while Fig. 3 shows it closed.

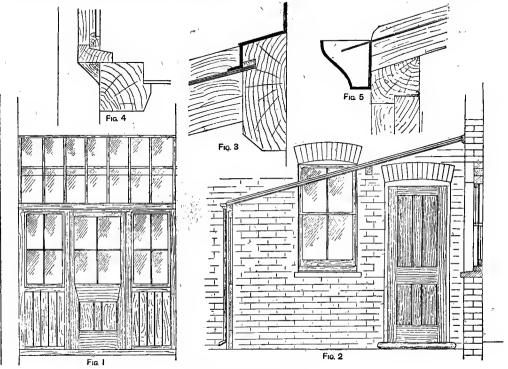
Revarnishing Violoncello.—A violoncello is but rarely French polished; the usual medium for violoncellos is a spirit varnish finish, therequisite tint being gained by colour incorporated with the varnish in preference to etaining. It is a rather difficult job to match the colour il left on in patches. More satisfaction is assured if a clean surface is worked on by removing the old varnish off the whole of the portion that has been repaired. Then proceed as follows. Dilute 3 parts of good quality copal varnish with I part turpentine, and set aside in an oven till quite hot; then apply to the bare wood, using a bristle brush. It acts as a grain filler, but to avoid the use of glasspaper again, any excess should be at once removed by a pad of wadding secured in a covering of soft rag; moisten this with turpentine, and apply to the varnished surface before it has had time to harden. The surface, when quite hard (say in two hours), is ready for spirit varnish, which is made by dissolving 202. of bleached shellac, 202. of guns andarach, and 202. of Venice turpentine in 4pt. of methylated spirit, the requisite colour being given to it by extracts of red sanders wood and turmeric; 202. of each should be steeped in separate bottles, each containing 4pt. of opirit. Then, by adding small quantities of each to the varnish in varying proportions, an amber or a red tone, as may be required, will be gained. The varnish, when stained, should be strained, and should be applied

Painting Croquet Balla.—A paint that has been much used successfully for croquet balls is made by thinning white-lead ground in oil with equal parts of raw oil, thickened oil, and turpentine. Give the balls two coats of this paint, allowing four days to harden after each coat, and finish with two coats of harderlying body varnish. The thickened oil imparts elasticity to the paint and prevents chipping off. Another method is to apply two coats of thick celluloid varnish over the paint, or apply a colour coat by mixing zinc white with celluloid varnish. This forms an excellent protection for the balls against hard wear and moisture, and will not crack as do most other varnishes. Use the zinc white in dry powder, not in oil.

Elastic Paint for Collapsible Boat.—Below is a recipe for a slate colour paint that will not crack, suitable for a canvas collapsible boat to be used on salt water. The canvas should be allowed to dry thoroughly in a warm room. Then apply two coats of double-bolled Battic linseed oil, the oil for the first coat to be slightly warmed, so that it will penetrate into the canvas. When thoroughly dry, apply two coats of composition made as follows. Dissolve ioz. of pure rubber (caoutchouc) in | pt. of solvent naphtha (coal-tar naphtha), and mix with | pt. of boiled Baltic linseed oil and | pt. of oak varnish. Mix all well together, and use as a medium for mixing some powdered graphite to the consistency of ordinary paint; a little white-lead pasts paint may be added to produce the slate colour. This forms an admirable preservative against the action of salt water, and is quite flexible and durable, and dries with a glossy surface if prepared from copal or carriage varnish. The graphite (blacklead) used in the preparation affords excellent protection against weeds adhering to the bottom of the boat, and also accelerates the speed of the craft.

Roofing-in Back Yard.—Figs. 1 and 2 are elevation and section of a roof and front framing in a yard situated between two brick walls at the rear of a house. The front framing consists of 3-in. posts and rails, with 1-in. sashes at the side and 1-in half glass doors. Below the subsill is i-in. beaded matching. The skylight is composed of 2-in. by 2-in. rebated and chamfered bars, tenoued at the upper ends into a 4-in. by 1-in. wall plate (see Fig. 3); the lower ends of the bars rest on the splayed head of the front framing. The bars are cut off in a vertical line with the framing below, and the glass runs past the end 1-in. Along the front is fixed a moulded iron gutter covering the ends of the bars, the water being carried away by a pipe with a shoe discharging over or near a yard gully. The bars next the wall are single rebated and chamfered, and are fixed to wood plugs driven into the joints of the brickwork; the bar next the scullery window is fixed in the same

ready for polishing without disturbing the colours requires an intimate knowledge of the characteristics of the woods employed, and of the action of the chemicals and mordants. Thus some mordants have a chemical affinity for certain colouring pigments, whilst on others they may have an opposite effect. The usual method is to employ the mordant first, but sometimes the order is reversed. In any case, the colouring matter will more readily strike in if the veneers are quite damp, and after the staining gradual dyeing should be the rule, rather than hasty dyeing, to enable the veneers to be immediately used. If an iron tank can be used with a steam jet to keep the contents boiling, the dyes will have far greater penetrating power. The chief mordants for use in this work are obtained from iron, tin, copper, aluminium, and potash soda, whilst the colouring substances include vegetable roots, and barks and berries, with acids and anilines. For the purpose of



Roofing-in Back Yard,

manner, as near the centre as possible. A purlin 41 in. by 3in. is fixed underneath the bars and tailed into the wall at each end to support the roof. A small spandril sash and frame will be required to fill up the space above the roof and the arch to the window; this might be fixed, but as ventilation is required it will be better if made to open in a light frame with a sill (see Fig. 4). The whole of the work should be glazed with 21 oz. clear sheet glass, unless obscure glass is preferred, when white Muranese would be most suitable. The roof light should be glazed as follows. First give the rebates and all parts of the bars a coat of good red-lead and oil colour. When dry, run along the rebates a layer of putty, not too stiff, to form a bed for the glass; lay the glass in place, pressing it down to the putty by rubbing the fingers along the edge. When the glass is firmly bedded, drive some sprigs along the edges to keep the glass in place, after which the glass and wood in the rebate should be given several coats of good paint; no back putty should be used. Fig. 5 is a detail of the eaves guttering.

Dyeing Veneers.—Dyeing veneers must not be confounded with staining veneers. The latter in most cases stains the woods sufficiently deep for French polishing, but it is a usual plan, as they do not always strike deeply into the woods, to apply the stains after the articles are made and cleaned up ready for polishing. To be successful in dyeing veneers so that the colours will venetrate right through, or to such a depth as will enable the veneers when "laid" to be cleaned

experiment the following details are given. Brown.—
Mordants: Bichromute of potash, permanganate of potash, sulphate of aniline, or alum. Brown colour being gained by a combination of red, blue, and yellow, any of the products of the vegetable kingdom yielding these colours may be used in varying quantities; on the other hand, bichromate of potash, permanganate of potash as mordants, with sulphate of auliline as a colour agent, will give several shades of brown, or after the mordant has been used, a weak solution of aquafortis or oil of vitriol may be tried, which, however, gives a rather scorched or burnt appearance. Mahogany.—
Madder root and extract of logwood should be used for colouring purposes, with pearlash as a mordant. Carmine, Brazil wood, dragon's blood, alkanet root, madder, red sanders, and logwood also give varying shades of red. Yellow.—Use turmeric, saffron, fustic, gamboge, and barberry root, with pearlash or potash as mordants, or acetate of copper on dyes of blue and yellow; also verdigris dissolved in acetic acid. Blue.—Use indigo with vitriol. Black.—Use extract of logwood with acetate of iron, which is made by steeping rusty iron in common vinegar.

Honey Soap.—Honey soap may be made by adding to

Honey Soap.—Honey soap may be made by adding to 40 lb. of white curd soap 3½ oz. of citronella oil, 2½ oz. of lemon grass oil, and a small quantity of aniline yellow the third of making, is described in a paragraph on making carbolic soap on p. 116.

Refuse Destructor.—Excluding ashes, the ordinary refuse from a small establishment may hest be destroyed by burning it in the kitchen fire. This applies to vegetable refuse, fish heads, and such like. Garden rubbish is usually burnt in a heap in the garden. If circumstances make this undesirable, a simple brick fregrate should be built, with a closed iron door and as long a flue as possible, for the chief essential is a good draught. A grate 12 in. square will probably be large enough; it must be arched over, and at the back a sloping hearth should be constructed, with an irou door over it through which the refuse can be thrown. The refuse is thus submitted to a drying process on this back hearth and is afterwards raked forward on to the fire. All the heated gases from the fire must travel backwards over the sloping hearth on their way to the flue, which should be carried up the gable of some building to the greatest height possible. Air is admitted to the furnace only through the fire bars. If the draught is good enough, the refuse may be made to burn without the addition of any other lue!

Extending Kitchen Table.—The following are particulars of a method of extending a kitchen table. A leaf is made of two boards, each 3ft by 9in. by 1in., fastened together with dowel plns, and two 3in. battens are screwed on underneath, these extending beyond at one end of the leaf by 2in. so as to fit under the overlap of the table top. On the end of the table two wood brackets A and B (see the illustration) cut from 1-in. board are hinged. Before screwing one of the brackets to the table, a piece 4 in. by 2 in. by 1 in. is screwed on to

4 per cent., and it is exceedingly rich when the unoxidised hydrogen exceeds 5 per cent. The reason why
the percentage of unoxidised hydrogen plays such an
important part in the choice of a gas coal is that when
the coal is distilled, every 16 parts of oxygen unite with
2 parts of hydrogen to form 18 parts of water, leaving
only the hydrogen over and above that required by
the oxygen for the production of hydrocarbons. From
these facts it will be seen that the choice of a steam
coal depends largely on the amount of fixed carbon it
contains, while a gas coal requires a good proportion
of volatile matters, and over 4 per cent. of unoxidised
hydrogen, and the sulphur and ash in both descriptions
should be as low as possible. With regard to the loss of
coal when left for a time in the open air, the information
ou this point is not very conclusive, but it is usually
assumed that in the presence of moisture, which is the
condition prevailing when coal is stored in the open air,
the sulphur of the irou pyrites undergoes oxidisation;
this results in a rise of temperature sufficiently high to
distil the coal partially, and thus drive off some of the
hydrogen and carbon, the coal consequently losing a
portion of these elements.

Weather-struck Lint. Fire I shows for the seather.

Weather-struck Joint.—Fig. I shows a form of weather-struck joint which, unfortunately, is very common and is ignorantly made with the idea of improving the appearance of a building by means of the sharp lines of the upper edge of the bricks; however, as a shadow is not formed, the effect is lost at a very short distance; and the disadvantage of this joint is that a ledge is formed on which water lodges, and in winter freezes and destroys the joint and the upper edge of the brick. A far better joint, properly termed a weather-struck joint, is formed by striking the mortar in the opposite direction to that illustrated in Fig. 1,

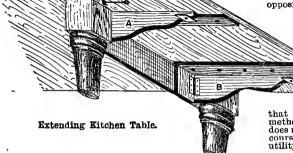


Fig. 2 Fig. 1 Weather-struck Joint.

that is to say as shown in Fig. 2. By this latter method the upper edge of the brick is protected, water does not lodge, and a sharp shadow is presented at every course. Thus improved appearance is combined with ntility_

course. Thus improved appearance is combined with utility.

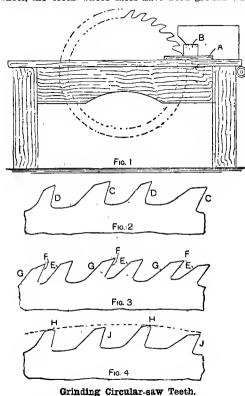
Covering Counter Top with Zinc.—When first cutting the sheet zinc for covering a counter top, make the width of the metal about I in. greater than the counter. If the sheet does not rest flat, take each of the corners alternately, and pull them over in a broad curve across the diagonal of the sheet, and let each in turn spring back; this usually renders the sheet pretty flat. Then bend down at right angles \(\frac{1}{2}\) in. along each long edge of the sheet, so that these edges will lap over and fittightly to the wood top. Also countersink one end of these joints occurs the wood must be cut away, so that the countersunk seam will rest flush in the groove. Then place each piece in position, and float the solder across at each lap seam. Now cut some strips of zine 1\(\frac{1}{2}\) in. Fit these so that the lower part laps underneath the wood top, and the top edge is level with the counter top. Solder the top edge of these strips to the fit top already in position. On the under side of the strip, ordinary tin tacks about 9 in. apart, driven through small holes in the zinc into the wood, will render it secure. Next remove all the surplus solder from the top outside edges with a float, rub down quite smooth with fine emery cloth, and finish off the edg quite bright with a burnisher. The spare solder on the top cross seams is removed with a sharp scraper, and alterwards rubbed down as above. To clean the zinc, mix a little raw spirits with some fine sand, and scourte the whole of the metal has been scoured in this way, dust some whiting over it and polish with a clean dry cloth.

Verge Watch Stopping when on its Back.—The cause of a verge watch not going when lying on its back may be that the top verge pivot may be bent, the pivot hole may need bushing, the balance may foul the balance cock, or the hairspring may foul the balance. Hold the watch movement in the position in which it stops, and carefully observe all these things.

raise the bracket so that it overlaps the other bracket when closed up. The battens are fixed so as to slide between the brackets to keep them open, and two wood turnbuttons are screwed on the battens at each end, and when turned round hold the top to the brackets, thus preventing the top being tilted. Two iron hooks and eyes are screwed to the leaf and table top, and keep the leaf from being dislodged. When the leaf is not required, it can easily be removed and put on one side and the brackets turned back, these being hidden when the tablecloth is on. when the tablecloth is on.

Comparing Samples of Coal.—In comparing the merits of different samples of coal from analyses it is essential to know whether the coal is intended to be used as a steam or as a gas coal, as there is a distinct difference between the two descriptions. This will be best explained by means of the accompanying analyses of a gas and a steam coal respectively. Steam coal carbon, 9012; hydrogen, 4'33; nitrogen, 1; sulphur, 0'85; oxygen, 2'02; ash, 1'68; and coke, 86'53. Gas coal: carbon, 52'24: hydrogen, 5'42; and coke, 86'53. Gas coal: carbon, 52'24: hydrogen, 5'42; and coke, 35'6. It will be seen that the steam coal contains a larger amount of carbon than the gas coal, and that this carbon exists to the extent of 86 per cent. in the fixed form as coke, and this is what is required in a steam coal; but in the case of a gas coal only 35 per cent. Other of the carbon exists a coke, the remainder being driven off in distillation, but this description of coal would not be so well adapted as a steam coal by reason of the volatile carbon producing large quantities of smoke. One piece of information relative to the value of a coal for gas-making purposes is afforded by an elementary analysis, viz. the percentage of unoxidised hydrogen, by which is meant hydrogen in the percentage of hydrogen. It is usually understood that coal is very poor for gas-making purposes when the unoxidised hydrogen is less than

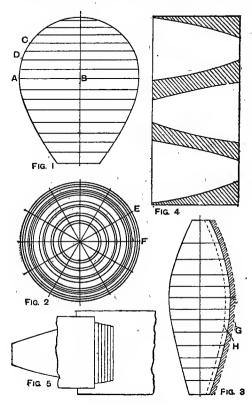
Grinding Circular-saw Teeth.—The following are instructions on grinding a circular saw so that the teeth will be of equal widths and at equal distances apart. To keep the space equal from point to point of the teeth, each tooth must have an equal amount of grinding on the face. The saw should be placed on the saw spindle and set running. While the saw is revolving, cut into a piece of wood as shown at A (Fig. 1): then place a piece of medium hard grindstoue B on the wood, and bring the stone gently towards the saw teeth so as to grind off the points. The stone must be held firmly with both hands while the grinding is being done. After the teeth have been ground, remove the saw from the spindle and place it under the emery-wheel. In Fig. 2 the faces of the teeth C are well ground back, while the faces of D are only lightly wiped with the emery-wheel. The guillet in each case should be kept to a uniform depth. In Fig. 3 the backs of teeth E and faces F should be well ground, while the backs G and the faces of E should only be very lightly ground. After each grinding with the emery-wheel, the teeth whose faces have been ground back



will be found to be low, as at J (Fig. 4). The saw is again put on the saw spindle, and the high teeth are ground down as shown at J (Fig. 4). This figure represents the teeth shown at Fig. 2 after they have been once under the action of the emery-wheel. The tops of the teeth H are filed with a topping-file until the flat places caused by the grindstone disappear, when the saw is again set running, and the points of the teeth are ground off by the method shown in Fig. 1, after which the teeth are brought under the emery-wheel and treated as before. After being thus treated a few times the teeth will become equally spaced and, if properly run down and carefully topped, the saw will be perfectly round.

Paper Balloons.—The following are directions for making paper balloons. First draw an elevation of the balloon it is intended to make, either full size, on the foor, or to scale. The shape here illustrated differs slightly from that of balloons usually sold ready made, being wider at the mouth. This shape, however, is not so liable to catch fire when swayed about by the wind. Divide the elevation into any number of parts (the more the better) by horizontal lines as shown in Fig. 1. Take the radius of the balloon on each line as AB, describe circles (Fig. 2), and divide these into twelve parts by

radial lines. Then to make a pattern, draw a perpendicular (Fig. 3), with horizontal lines at the distances of the horizontal lines in Fig. 1, but measured on the circumference as CD. Then set off on each line from the perpendicular half the distance between the radius lines (Fig. 2) on the corresponding circle as EF, and draw a line through the points thus found, and the result will be the shape of each section. Allow a little (say in.) on one side when cutting out for pasting. Each section will be made up of one, two, or three pieces, according to the size of the balloon to be made. If the pieces are cut as shown in Fig. 4, a great saving of paper results. To paste these pieces together, place them in a pile on the table or bench with the edges flush and a piece of waste paper under the pile. Now rub the top sheet with the thumb nail until each piece is moved back from the one immediately under it about in. Place a piece of waste paper about the same distance from the edge of the top sheet,



Paper Balloons.

and pass the paste-brush over the whole of the exposed edges. Fig. 5 will explain what is meant. Now place two of the completed sections together so as to look like Fig. 3, with a small part projecting as shown by the dotted line G. Paste the edge of the under section—that is, the part hatched—and turn it over on to the dotted line H. When each two of the sections have been joined in this way, proceed in the same manner to join these together till the whole is complete. A circular piece of paper is cut out to join the sections at the top, and a loop of string should be pasted to the top to suspend the balloon whilst inflating. A ring of wire with two cross pieces is fitted to the bottom of the balloon, and the inflammable material—tow soaked in methylated spirit—is fastened at the junction of the cross pieces.

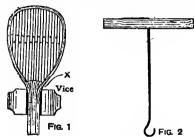
Rose Soap.—Scented soaps are usually made from good white curd soap, which is cut into flakes by machinery, partly dried on trays, then heated in steam jacketed paus till pasty, when the scent is stirred in. The soap is then rolled into bars of the desired shape, and cut into tablets; these are compressed and then stamped in hand presses with dies. The quantities of materials for 40 lb. of rose soap are oil of rose geranium 1½ oz., tincture of musk ½ oz., and tincture of bergamot 1½ oz.

Cutting Hole in Porcelain or Fire-clay Bath.—
The so-called porcelain hath is really made of fire-clay, and has a porcelain enamelled surface. The holes in such baths are not drilled, but are cut and countersunk with a hammer and small sharp chies! in the same manner as a mason would cut a hole through a stone slab. Great care is required in cutting such a hole, which should be large enough to allow for the expansion of the brass overflow connection whenever it becomes heated. Many baths are ruined by ueglect of this latter precaution. When ordering new baths, it is advisable to let the makers cut all necessary holes.

Pliable Composition for Comical Faces.—A cheap and suitable composition for an elastic composition that may be used for making comical faces such as are sold in the streets may be made from glue 6 oz., water 26½ oz., glycerine 26½ oz., sugar 6 oz., harytes 15 oz., and sufficient venetian red to give a pink tint. Soak the glue in the water, melt down by heat, stir in the glycerine, then the sugar, finally the barytes and venetian red, and mould while the mixture is fluid.

venetian red, aud mould while the mixture is fluid.

Restringing Tennis Racket.—A small bench vice with 3-in. or 4-in. jaws will be strong enough for use in stringing rackets. Put a piece of soft thick leather on each side of the tennis bat. The jaws of the vice must hold the bat right up to the shoulders (see Fig. 1), or when pulling on the string the bat will break at the part marked X. When the main strings are tightly threaded down in the vice, tighten from the middle string of the racket, using for the purpose a steel button-hook fixed in a wooden handle (see Fig. 2). Suppose, for example, the bat has eighteen strings (that is, niue on each side), pull first with the button-hook on No. 9, and hold the string with the left hand while No. 8 is pulled, then hold No. 8 while No. 7 is pulled, and so on down to No. 1. The bare end of No. 1 has already been passed beneath the loops of Nos. 5 to 1, and the slack must now be pulled



Restringing Tennis Racket.

through the loops with blunt pliers, No. 1 being held as Nos. 9 to 2 were held until the slack is pulled tight. Treat the other side (strings 9 to 1) in the same way, the sides heing pulled to about the same tension, to keep the bat in shape, and a support being provided to keep the head from being pulled down. When the main strings are tight and musical like a harp, work the cross strings in over and under each main string. Before this, however, go over the main strings again, and bring them to the same tension as before, using the button-hook and fingers in the manner already described. The main strings may have to be gone over half-a-dozen times before the right tension everywhere is obtained, and the strings finally fastened off. A pad of soft cowhide leather 2 in. wide, with a hole in it for the thumb, can be used to protect the hand when pulling on the strings.

Canse of Blue Deposit in Electro-tinning.—The

Cause of Blue Deposit in Electro-tinning.—The cause of an electro-tinning solution giving a blue deposit of tin is probably a deficiency of tin in the solution. The deposit is thin and poor, and the coat is put on, under strained conditions, hence its blue appearance. Tin solutions rarely feed themselves automatically from the anodes. It is, therefore, necessary to keep up their metal strength by adding some concentrated tin solution to the bath from time to time, or to arrange a reservoir of the feeding solution with a gradual but small leakage into the working solution.

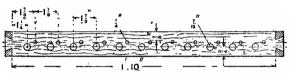
but small leakage into the working solution.

Preventing Treacle Toffee becoming Moist.—
Treacle toffee is most liable to soften by absorbing moistnre from the air, and this cannot be prevented except by keeping the toffee in closed bottles or tins. It will be best to make the toffee principally from white sugar, colouring and flavouring it by the addition of a small quantity of brown treacle. The sugar and treacle chould be placed in a pan with a little water and a pinch of cream of tartar, and heated to "hard crack"—that is to say, until a piece taken out and cooled breaks with a snap. When this point is reached, the hutter may be stirred in and the toffee moulded. The cream of tartar

prevents the crystallisation of the sugar, and, as there is not much treacle present, the tendency to become sticky will not be so great.

Waterproefing Paper.—For waterproofing and alrproofing paper, dissolvell lh. of white scap in lqt. of water.
In another quart of water dissolvel loz. of gum arabic and
5 oz. of glue. Mix the two solutions, warm them, soak
the paper in the liquid, then pass the paper between
rollers, or merely hang it up to dry. Another recipe is
as follows. On a table lay a quire of paper, open it out
flat, and rapidly iron it with a very hot iron against
which is held a piece of wax; this, melting, runs down
on the paper and is absorbed by it. There is no waste,
as the wax that is not absorbed by the top sheet runs
through to the next.

Egg Turner for Incuhator Drawer.—The accompanying illustration shows an independent turner which turns one row of eggs in an incuhator at a time; this turner will be of the greatest convenience when eggs are chipping, as those eggs should be placed chip upwards and allowed to remain so until hatching takes place. One important point in the construction of this turner is that the holes in the back and front of the drawer frame should be exactly opposite each other; in order to ensure this, screw the back and front of the frame together and bore both at the same time, then set the holes out on the front piece. This drawer frame should be made of sound deal, \(\frac{1}{2}\) in. thick, \(2\) in. deep, and \(22\) in. inside; this size will accommodate twelve rollers, and each roller will hold nine hens eggs placed end to end, so that a hundred and eight eggs can be turned in a quarter of a minute. The roller holes are bored with a \(\frac{1}{1}\)-in. this bit, in order to allow a \(\frac{1}{2}\)-in. Trom the inside of the drawer frame, and \(\frac{1}{2}\)-in. from the hottom of the frame; the remainder of the roller holes should be \(1\)-in. apart from centre to centre. The ends of these rollers should be allowed to project \(\frac{1}{2}\)-in. through the drawer front, and a l.in. wooden knob glued on the end of each roller, so that the eggs may be turned without opening the drawer. These rollers are procurable at any oilshop, and are sold as plant sticks;



Egg Turner for Incubator Drawer.

they are of foreign wood, very hard, and will stand a warm, damp atmosphere. The knobs have a wooden screw, and when this screw is removed the knobs can be fitted to the roller ends. (After removing the screw, run in het \(\frac{1}{2} \) in hit in order to cut the thread out, and the knob will then fit the \(\frac{1}{2} \) in. twist bit, the first hole heing bored l\(\frac{1}{2} \) in from the inside of the drawer frame and \(\frac{1}{2} \) in. from the top of the frame; bore these holes \(\frac{1}{2} \) in. apart. The hest rods for the purpose are stair rods, as the surface is perfectly smooth and allows the egg to elip freely when the roller is turned. The garden sticks used for the rollers will be found a little rough, thus gripping the egg and turning it.

Bonfire.—In building a honfire, place the most com-

Bonfire.—In building a honfire, place the most combustible materials, shavings, boxes, tar-barrels, etc., in the centre. Then arrange one or two rows of barrels or large timbers in such a way as to make flues leading from the outer edge of the pile to the centre, and build the heavier timbers over these in a conical heap. One or two tar-barrels or a few gallons of parafin thrown on the heap will ensure its burning. Leave the flues clear, and light up by means of a long stick shoved up one of the flues to the shavings and chips in the centre.

centre.

Hydrogen Peroxide.—Oue method of preparing hydrogen peroxide is as follows. Barium peroxide is suspended in water and just sufficient sulphuric acid added to combine with the whole of the barium, the hydrogen peroxide formed remaining dissolved in the water. A ten-volume solution will yield ten times its volume of oxygen on heating, and to prepare it the following details have to be taken into account: 169 grammes of barium dioxide and 98 grammes of sulphuric acid yield 34 grammes of hydrogen peroxide, and 35 grammes of hydrogen peroxide yield 16 grammes of oxygen or 11°2 litres, and to form a ten-volume solution 1°1 litre of water would be required. The quantities to take are, therefore, 169 grammes of barium peroxide suspended in 1°1 litre of water, and 98 grammes of sulphuric acid very gradually added during cooling and shaking. See also Series I., p. 306.

Grinding and Polishing Bevel Edges on Plate Glass.—Below are hints on grinding and polishing bevel-edge plate-glass circles. The circle should be embedded in plaster-of-Paris on a circular plate, rather larger than the largest plate to be bevelled, and should revolve on an iron rod below as support, the iron rod sliding in a bearing on the lathe, and being gripped at the proper height by a screw. The iron plate is fixed horizontally, and the wheel or grinding disc is set at the proper angle to produce the \$\frac{1}{2}\text{in.}\$ or \$\frac{1}{2}\text{in.}\$ bevel required. The grinding disc is of steel, and is moistened with water and fine sand. The iron plate holding the circle is moved up till the edge of the glass just touches the face of the grinding disc, which is then caused to revolve, and as the disc grinds the edge of the glass away, the support is revolved until the whole of the edge is ground off; then the iron plate is moved up again and a further portion of glass is removed, and this operation is continued until the bevel is formed, only that portion (about \$\frac{1}{1}\text{in.}\$) embedded in the plaster heing left unground. After grinding, fine emery is used to remove the scratches made by the sand, and then the hevel is successively powder, discs of wood, wood covered with leather, and, lastly, wood covered with lett.

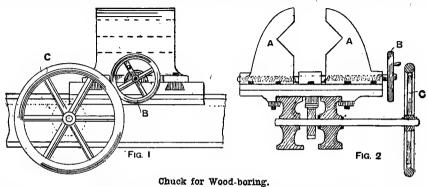
Chuck for Wood boring.—True boring may be done

Chuck for Wood-boring.—True horing may be done with a chuck as shown in Figs. 1 and 2. The chuck is capable of adjustment to hold round or square work of any reasonable size. The height of the angles A must of course be equal to the height of the mandrel. The jaws of the chuck are closed by a right- and left-handed screw,

boiler impossible unless it is sunk about 12 in. In the ground. No objection can be urged against so sinking the boiler, and it is even then much less expensive and troublesome in fixing than a saddle boiler. If the Loughborough boiler is not adopted, the saddle boiler is the one that should be used. This boiler must be fixed in a covered pit helow the level of the greenhouse. For a greenhouse, allow 32-ft. run of 4-in, pipe per thousand cubic feet of space in the house. For a cool bouse, 25 ft. per thousand, or an equivalent length of smaller pipe, will do. For 3-in, pipe add one-third, for 2-in. pipe double the length.

2-in. pipe double the length.

Number of Slates Required in Roofing.—
The number of squares of 100 ft. sup. should be taken from the bill of quantities or determined as follows. Take from the section the distance up the slope and multiply this distance by the length along two or four sides as the case may be, the quantity for a hipped or gabled roof being the same. Deduct the space occupied hy chimney, skylights, traps, dormers, etc., and add the length by 6 in. for waste in cutting around all deductions. Add length by 6 in. on each side for waste in cutting to hips, valleys, and irregular gables. No allowance for square gables or ridge. Allow length by gauge or margin for waste on doubling course at eaves and curb. Total this up to arrive at the amount inserted in the hill of quantities. Then according to the size of slate and margin shown will be the covering power of each. For example, countess slates 20 in. by 10 in. centre nailed, with 3 in. lap, the gauge will be \$\frac{8}{2}\$ in. and if the



operated by the small wheel B, while the work is advanced to or receded from the horing bit by a rack-and-pinion movement controlled by the large wheel C. Illustrated instructions on boring bits and special reaming tools well adapted for conical boring appear on p. 118.

Alloying Lead and Zinc.—Lead and zinc do not alloy well together. Even when meited and well stirred in the meiting-pot they will sgain separate if allowed to remain quiet. When melted, then well stirred and poured into a casting mould, they will partially separate before they have time to solidify. The zinc will rise to the surface, as it is the lighter metal, the specific gravity being 7146, and the lead will sink to the bottom, as it is heavier, the specific gravity being 1136. Castings made of a mixture of lead and zinc are never satisfactory, and there is no flux that will make them alloy well together, although the addition of a little arsenic has been suggested as an aid.

Carbonate of Soda as Washing Powder.—The ordinary pure carbonate of soda, which is mild in its action, will do much more work than the ordinary washing soda, and does not froth like the washing powders. A very fine carbonate of soda, known as the "sesquicarbonate," is made for this purpose and is in the form of a fine crystalline powder and dissolves readily in water.

Heating Greenhouse.—For a greenhouse without forcing frames the Loughborough type of boiler is good. It is made and sold complete with pipes and parts for simple fixing. Forcing frames fixed along one side of the house usually are heated by two 2-in. pipes run through the frames. The pipes may be 3in, or even 4in., according to the purpose for which the frames are required. The large pipes are used when the frames are similar to melon pits. The frames are usually at a little lower level than the greenhouse, and this makes the use of a Loughborough pattern

roof contains 8 squares = 800 sq. ft. the number of slates will be $800 \div \frac{85}{144} = \frac{800 \times 144}{85} = 1356$.

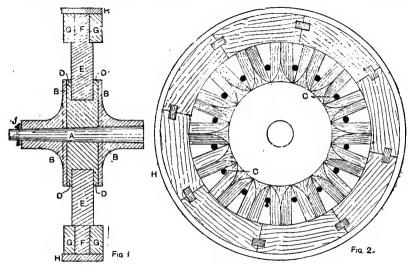
Material for Setting Gauged Brickwork.—Brickwork that is to be carved should be set in a mixture of shellac varnish and white-lead ground in oil, the two materials being well mixed and knocked together. This mixture sets firm in a few hours, and eventually becomes so hard that if bricks bedded with it are separated the bed will tear away with it a portion of the brick. Lime putty should never be used for work that is to be carved, for at the first blow of the carver's tool the bricks would move on their bed, as the lime does not set, but simply dries, and remains soft and friable. Lime putty, however, is used for setting gauged work in general, and answers the purpose well. It is prepared in precisely the same way as plasterer's putty. The lime is slaked and run through a sieve to remove lumps and impurities, and is used for setting in a liquid state. Mason's setting material for stonework is made of slaked lime and stonedust.

Cementing Tiles to Iron.—If the iron surface is any part of hot apparatus, the tiles cannot be made to adhere satisfactorily whatever cement is used, and the only good means of fixing the tiles is to drill and tap holes in the plate to receive screws at the corners of the tiles. Suitable screws with washers can be readily obtained. The screw does not go through the tiles, hut comes outside the extreme angle, so that one screw and washer will cover and secure a corner of four tiles where they meet. If the iron surface is always cold, then probably red- and white-lead will prove as good as anything. Mix moist white-lead and dry red-lead to the consistency of very soft putty. Thin a small portion with holied oil to paint consistency, and with it paint the surface of the iron and the backs of the tiles. Now spread a thin layer of the lead putty ou the back of a tile, and press it firmly on to the iron surface; the tile will adhere at once. The work will dry and set hard in a few days.

Fixing High Flagstaff.—It is not considered advisable to fix a flagstaff either in concrete or in soil. If the ground is soit, get five large stones, say 3 ft. 6 in. by 3 ft. 6 in. by 1 ft. 3 in., well bedded in the ground. Drill holes through the centre of each, and fix in. eye-bolts with nut and washer, fixing one in the centre and one at each angle. Fix at the lower end of the mast a 2-in. by 3 in. band with double eyes and a bolt to go through them and through the one already fixed in the centre stone, thus forming a hings to the mast. Have also a band at the top of the mast, with four eyes riveted or threaded to the band, each pointing to each corner stone. Fasten the guy to these while the pole is down on the ground; get the length of the guys, and fasten a screw coupling to the end of each guy. Hings the mast to the eye-bolts in the centre stone, and hoist up; hook the guys to the corner stones, and tighten with the coupling to bring the mast upright. The use of wire guys is advised. If the site is rock, drill holes about 12 in. deep, and fix eye-bolts in with lead or cencrete, having the holts fixed in the concrete.

Artillery Wheel.—Figs. 1 and 2 show respectively a sectional view and side elevation of an artillery wheel. The flanges B, of iron \(\frac{1}{2} \) in. thick, are shrunk on to the gunmetal box A, and sixteen \(\frac{1}{2} \) in. bolt-holes, as C (Fig. 2), are put through each flange. In putting the flanges together, insert four bolts only, and make thirty-two hlocks of oak, as D (Fig. 1), to fill up the space between the flange and spokes. When the spokes are all driven

surface than if finished out very bright, especially if the surface is at all uneven or badly cleaned up. A process of finishing known as "dry shining" strikes a medium between high-grade finish and simple spirit varnishing. In the crudest form of this process the work is simply oiled and a wet rubber of polish applied all over, not sufficient being used to fill the grain, but just euough to still the oil. This treatment is generally considered good enough for the insides of drawers, cuphoards, etc., the object being to remove an unfinished appearance and to prevent the surface getting as dirty as it otherwise might. From this better degrees of finish may be reached. The work may be oiled, filled in, one or more rubbers of polish laid on just to fill up the grain, and then an even coat of spirit varnish applied. If the articles are of white wood, they may be stained to imitate some choicer wood before oiling; and if the goods are likely to be subject to hard wear, the coating of spirit varnish may be omitted, the polish being worked out fairly dry to ensure the removal of all oil; a coat of oak or painter's varnish could be applied to, as the polish being worked out fairly dry to ensure the removal of all oil; a coat of oak or painter's varnish could be applied to a stage nearly approaching that for spiriting, but the surface of polish when hard is dulled by rubbing or brushing with fine-grade pumicestone power or flour emery, in which condition it may be left. If a gloss instead of a shine is preferred, the wood should have a smart rubbing of beeswax and turps. Black work has



Artillery Wheel.

in, as E (Fig. I), put in the rest of the bolts and cut square tenons 2 in. by 2 in., as F (Fig. I); the felloes are 31 in. deep by 5 in. wide, as G (Fig. I), and the tyres are 4 in. thick by 5½ in. wide, as H (Figs. I and 2). The Drabbles axle is of 2½ in. diameter, fitted with a collar and linch outside the box, as J (Fig. I).

Preventing Sound Passing through Party Wall.—
The only method of effecting this purpose is to build the party wall solid, taking care that all the joints are well filled with mortar. No joists should be fixed in the wall, and the space behind the skirtings should be filled with plaster, and not left hollow. The plaster used for the wall should be of good quality. A further precaution would be to cover the wall with three-ply Willesden paper before fixing the ordinary wall-paper.

paper before fixing the ordinary wall-paper.

Easy Method of Finishing Woodwork.—The process of French polishing as a means of finishing furniture and woodwork is generally regarded as a most tedious operation, owing to the number of solutions to be used on work that is built up of various kinds of wood, in bringing it up to uniform colour, and in polishing it so as to bring out and reflect to the fullest extent the markings or figure of the wood. On high-grade goods with a hright lustrous level finish this so. Yet much furniture is not of high-grade finish, so far as the polisher is concerned; for instance, bedroom furniture that is stained green is rarely finished out extra bright, and the same may be said of fumed oak goods and many American organs. In fact, some goods look far better with a faintly lustrous polished

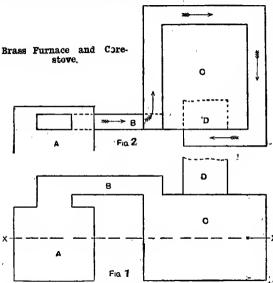
a specially chaste appearance thus finished, and the black stain of logwood and iron solution may be used, aniline spirit black being amployed for imparting density of colour to pale shellac polish. If it is not convenient to use varnish, and a simple solution of shellac in spirit (4 oz. orange shellac dissolved in 1 pt. methylated spirit) is the only solution at hand, a passable finish may still be gained by enclosing the pad in a piece of soft rag and finishing out by working it in straight lines, after a body has been put on without a covering. When the articles must be stained, it will be found more economical to buy the stains ready made if only a small quantity is required. Dry shining has at least the merit of building up a surface that can be taken in hand again at some future time and French polished.

Spirit Level Casing.—A good way to protect a spirit level from injury when not in use is to case it in wood as is done with an oilstone. The level should fit in loosely enough to be easily taken out when required. Weil-seasoned English birch is a very good wood for these cases; and pieces of suitable size which have been used in old furniture, such as four-post bedsteads, etc., can be frequently picked up cheapat jobling joiners', wood turners', or marine stores. For ornamentation, a \(\frac{1}{2}\)-in. sash ovolo can be worked round the lid, which should be hinged with a back fap and fastened by a spring catch on a hook and eye. The case should he rubbed up from time to time with beeswax and turps.

Conveying Fumes from Gas Rings.—To convey fumes away from two gas rings fixed in a kitchen recess, the rings may be covered with a hood from which a pipe leads into the kitchen chimney. The hood must taper up from the full width of the opening at the bottom to a width of about 12 in. at the top, the angle being 45°. From the top of the hood a pipe not less than 6 in. in diameter must be led preferably into the chimney; if the pipe is taken to the open air through an outside wall, the apparatus will almost certainly fail.

Weed and Grass Killer.—For killing grass and weeds a strong solution of arsenic in caustic soda may be made by dissolving 6 oz. of caustic soda in 1 qt. of water, and boiling with white arsenic till it is saturated. This is a very deadly poison, and, therefore requires careful handling. A harmless material is chloride of lime; this may be sprinkled over the grass and then watered.

Brass Furnace and Core-stove.—Below are hints as to a method of fitting up a core-stove in conjunction with a brass furnace that will melt about 100 lb. of brass. The waste heat from the furnace may be utilised for warming a core-stove by carrying the fine from the back of the furnace under and round the corestove, the products of combustion eventually passing away by a fine chimney squal in height to the regular chimney. The inside of the stove should be of iron and the outside might also be of iron, but brick



would be much better. Fig. 1 (a plan) and Fig. 2 (a sectional elevation on XX) will give a general idea of the stove that can be altered to suit particular needs. A is the furnace, B the flue, C core stove, and D exit to stack. By constructing the flue in the manner shown in the illustration the gases will pass up one side, over the top, down the other side, round the bottom, and find an exit at the back, the heat consequently circulating all round the stove (except the front). About a brick and a half will be ample allowance, and a flue cover must be provided for the periodical removal of flue dust.

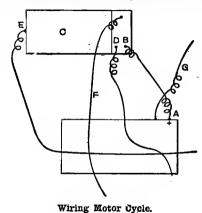
Carbolic Soap.—To make carbolic soap, saponify tallow bleached palm oil, and resin with caustic soda lye, the caustic soda being in slight excess. Convenient quantities are 50 lb. of tallow, 30 lb. of palm oil, 20 lb. of resin, and 17 to 18 lb. of caustic soda made into a lye of 24° Tw., or into two lyes, one of 16° and the other 24° Tw. When the soap is made, 10 lb. of Calvert's carbolic may be stirred in and the soap moulded. For a red soap use ordinary palm oil and add a small quantity of red colour. For making medicated carbolic soap, instructions are given in Series I., p. 300.

Hard Alnminium Alloy for Castings.—The hard aluminium alloy known as 6-per-cent, consists of 94 parts aluminium and 6 parts copper. This is largely used in the manufacture of the stay pieces and the framework generally of boats, and for similar purposes.

To make this alloy, a preparatory alloy of equal parts of copper and aluminium is first made and poured into strips or shallow moulds. It is exceedingly brittle, and readily pounds up into small pieces. A quantity of aluminium (say 44 lb.) is first melted, and when ready 6 lb. of the first made alloy known as hardening is added. This makes a good sound casting alloy. Another moulds. This makes a good sound casting alloy. Another alloy consisting of aluminium 97 parts, nickel 2 parts, copper ½ part, tungsten ½ part, and tin ½ parts also gives good results. The preparatory alloy in this case contains a proportion of aluminium, nickel, copper tungsten, and tin as in the first case, and a suitable proportion is added to the 97 parts of molten aluminium in the crucible previous to casting.

Dyeing American Cloth Black.—If the oil used in dressing American cloth has penetrated the fibres, the cloth cannot be dyed, and will have to be painted in order to alter its colour. But if the fibres will take adye, it is possible to proceed thus. Boil 5lb. of logwood chips with lgal. of water, strain, and make the decoction up to lgal; dissolve 802. of sulphate of iron in lgal. of water. Brush the back of the cloth first with the logwood solution, then with the sulphate of iron. If the dye is fixed at all, the process may be repeated after adding about 10z. of carbonate of ammonia to the logwood solution.

Wiring Motor Cycle.—The accompanying diagram shows the electric ignition connections of a Hercules petrol motor, mounted sither on a bicycle cratricycle. One wire travels from the positive pole A (marked +) of the accumulator to the terminal B on the coil C, and, after passing through the coil, passesout through the



terminal D, and thence to the contact breaker through the small tube, which regulates the contact breaker, then from the contact breaker to earth, along the frame to the handle bar, and along the bar to the ewitch handle. The secondary current leaves the coil at the opposite end E, and runs to the sparking plug, to earth, and to the A terminal on the coil. The wire F travels from the coil to the earth or engine clip, and the wire G travels to the switch handle.

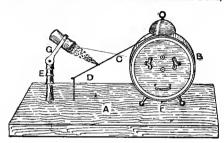
Removing French Polish and Stain from Marble.

—To remove red French polish and stain from marble, wet the marble with water and, whilst still wet, pass a sharp chisel along to remove the polish. Or try the effect of soaking the stains with oxalic acid (\$\frac{1}{2}\text{ox}\$ dissolved in \$\frac{1}{2}\text{ to of water}\$), then neutralise any acid that may be left by wiping over with common vinegar. If this does not suffice, use Castile soap and water with a little ox gall. If the stains are obstinate, make the mixture into a paste by thickening it with fuller's-earth, spread over like paint, allowing the paste to remain a couple of days before washing off.

Varnish for GolfClubs.—Spirit varnish is suitable for golf clubs, as it dries very quickly and colour may be added to impart a darker shade if deeired. For a brown colour, add dry brown umber or vandyke brown; for a red, a few grains of Bismarck brown per pint will suffice, or a rich brown can be gained by a careful admixture of brown and red. The following will give a quick-drying bright varnish. Methylated spirit, 1pt.; shellac, 4oz.; benzoin, 2oz.; and venice turpentine, loz. Add colour to suit requirements. Carefully strain through muslin. Apply with a camel-hair brush, and set aside in a warm room to dry.

Angus Smith's Solution for Coating Pipes.—
Iron pipes properly coated with Dr. Angus Smith's solution are not affected by either soft or hard water; but some difficulty may be experienced in properly coating small-sized iron pipes. The Angus Smith process is as follows. The original recipe consisted of 30 gal. of coaltar, 30 lh. fresh slaked lime, 6 lb. of tallow, 3 lh. lampblack, and 14 lb. of resin, well mixed, boiled for twenty minutes, and applied while the mixture is hot. The solution now generally used is composed of three and a half harrels of coal-tar, half a barrel of coal-oil, and half a barrel of pitch; 6 tons of gas-coke will be required for heating the pipes. The immersing tank should be made of wroughtiron, and be long enough to take a 9 ft. length of pipe. Put in sufficient coal-tar to half cover a pipe; pitch, heaten to a powder, is then sprinkled on the tar, and coal-oil is poured on the pitch. The pipes, heated from 180 to 200 F., or as hot as the hand can hear, are placed separately in the liquid, and turned over and over for two or three minutes, then reclined at an angle to drain, the lower end being kept clear of the liquid. The quantities named in the above recipe will be sufficient for about a thousand pieces, bends, branches, and straight pipes, or say three-quarters of a harrel of coaltar to a hundred 9-ft lengths of 4-in. pipe.

Clock Regulating by the Sun.—In many country districts watchmakers would find the following plan for correct timing by means of the sun very useful day by day. Take a block of wood A 14 in. by 6 in. and 2 in. thick, and arrange on it a timepiece B, thread C, wire D. and stand E for a burning glass. Any old disused alarum timepiece will do, as the alarum part only is required. To the small hammer part fix a wire hook, set the hand on the dial so that the alarum runs, and



Clock Regulating by the Sun.

leave it so. The going part is of no use; the alarum is simply wound a few turns only each day after the thread is in position. Make two small holes for the clock feet to rest in, and put a slender, screw through the bottom at Finto the wood block. The clock hell part, etc., is then ready. Next fit up the glass for the sun's rays. Take a lene of short focus and fix it within the lower end of the tube; this only costs a few pence. Make the metal band to hold it in position, and rivet this to the upright G, which can be of iron or brass filed flat at the top with a hole drilled across for the rivet of the band; this should allow it to be raised or lowered according to the period of the year when the sun is high or low. The thread is wrapped round the wire a few times. To find the position in which to fix the apparatus permanently, place it on the bench or on a bracket in the window side, facing south. Set it with a compass so that the alarum part is north and the lens, etc., south. To find the true 12 o'clock meridian line, make a mark where the sun shines on the pillar at the top, causing a shadow line at, say, 10 o'clock; then do the same at 2 o'clock, and with a pair of fine compasses place one point at the foot of the pillar and the other on the mark for 10 o'clock; turn it so as to reach the 2 o'clock mark, thus forming a part circle between the two, and midway between is 12 o'clock. Draw a line there, and the lens must show the sun's rays on this line, the thread of course just crossing above with the sharpest focus point shining on it. When the precise moment arrives, it burns the thread and the bell rings for a short of long time according to the number of turns previously given to it.

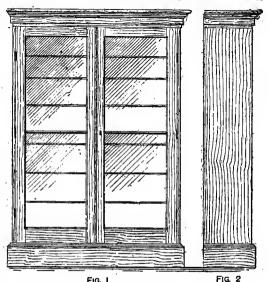
Mounting Pictures to Resemble Oil Paintings.—For mounting pictures to resemble oil paintings, a wooden frame is necessary. To make this four strips of batten l_1^2 in. by $\frac{4}{3}$ in. should be cut to the required lengths and planed and bevelled two-thirds of the width of the stuff, so that the outer edge of the stretcher is somewhat higher than the inside, and mitred in the usual way. The frame is now covered with calico drawn tightly over the surface and tacked round the edges. To mount and finish the

picture to resemble an oil painting, cut away all the margin, place the prlut face downwards on a perfectly flat surface, and coat with strong paste. Lay the canvas down on the picture and rub firmly on the back and edges, thus bringing the pasted surface into contact. When dry, size the surface of the print thoroughly and varnish either with copal or mastic varnish. Small prints may be mounted on pasteboard instead of being placed ou stretchers; this plan, however, is not generally satisfactory, as it is difficult to remove a picture so treated from the pasteboard should occasion arise, whereas it is very easy to strip a print off canvas without the least injury.

Lock-up Rockease—Figs. 1 and 2 are elevations of

canvas without the least injury.

Lock-up Bookcase.—Figs. 1 and 2 are elevations of a lock-up bookcase. The sides, top moulding, plinth, and door frames are of waluut, and the back, floor, roof, and shelves are of white wood, the shelves being faced with a walnut veneer 1 in. deep. The back is made for strength in the form of a nine-panel frame, and the shelves are held by walnut crossbare 1 in. wide; they rest on notched bars in the usual manner, the bars being cut at every 2 in. The shelves are 12½ in. deep, so that, if necessary, a double row of hooks of ordinary size can be accommodated, and even the largest sketch books.



Lock-up Bookcase.

At 2 in. from the bottom of the carcase, and resting on the first steps, the bottom shelf leaves a long open space, exceedingly useful for drawings, art magazines, and large papers, especially as the opening is below the level of the glass and therefore hidden. The height inside the carcase is 65 in., the plinth measures 6 in., the top moulding 3½ in., and the width from outside to outside is 43 in. The glass for the doors is in four panes, the width of the frames being 2½ in., except along the bottom, where it is 4 in. A light moulding divides the panes, and edges the frames and outer door. The top moulding is built on a frame, screwed down to the roof of the carcase. A bolt at the top and another at the bottom secure the inner door.

Action of Lime on Wood.—Pitchpine not protected (that is to say, the bare wood being in contact with the lime), will undoubtedly suffer more than seedpine. Lime, in the case of most pine woods, has the effect of converting and rendering volatile many of the essential elements of the pine, mostly those elements of a resinous character. Pitchpine, if not painted or coated with varnish on its surfaces, gives up these essential elements to an ordinary atmosphere more quickly than the majority of woods, becoming thereby a more brittle, exhausted, and altogether less trustworthy material than any other wood. This condition is not, of course, attained for many years. In contact with lime this disintegrating process will advance more quickly. If, however, the wood is thoroughly dried, and afterwards well painted or varnished, on all sides and ends, the volatilisation will be largely prevented, and the life of the wood will be in accordance with the protection afforded it.

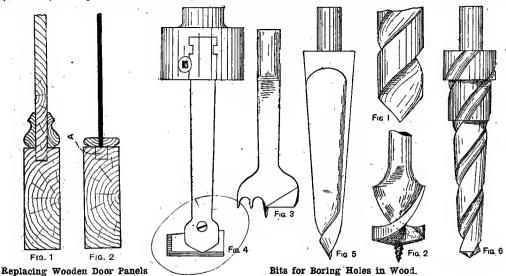
Grey-mottled Soap.—A genuine grey-mottled soap should be made in the ordinary way, the ingrediente being tallow 60 lb., palm kernel oil 540 lb., with the requisite quantities of caustic soda lyes; the lyes used are, first, of 16° Tw., and, second, of 24° Tw., about 90 lb. of solid caustic soda being required. The soap is separated by common salt from the glycerine and impurities, reboiled to a homogeneous paste, and then run into the moulding frames. A canvas bag containing the colouring matter is then pulled through the frame, thus leaving streaks through the soap. The colour may be made by intimately mixing 30 lb. of ultramarine blue and 4 lb. of lamphlack.

Replacing Wooden Door Panels with Glass.—Below is described the manner of replacing with glass the two top wooden panels of an ordinary door. Remove any mouldings that may be round the panels, as shown in Fig. 1; then bore a hole in the top left-hand corner of the panel, insert a saw, and cut all the way round close to the edges of the stiles and rails without injuring them. Then take out the portions of the panels remaining in the plough grooves, and fill up these grooves with strips, as shown at A in Fig. 2. These strips may be glued in if desired, or may be secured with sprigs, and must, of course, finish quite flush with the edges of the

and the floorcloth is seasoned, this taking from one to three years, and being an important bearing on the wearing qualities of the floorcloth. Borders and narrow widths are made several at a time and afterwards slit up.

widths are made several at a time and afterwards slit up.

Bits for Boring Holes in Wood.—For dead true
work, in all directions of the grain, bits of the kind shown
in Fig. 1 are used. These are best known in connection
with metal work, and the metal-working bits operate in
wood quite easily, but the same pattern bits are now made
specially for work in wood, and may be had from the
smallest sizes upto 2½ in. in diameter. A quick-feed bit
as shown at Fig. 2 is better adapted for boring short
depths in the end grain than for side-grain work,
its work in the latter case being very coarse. The
centre-bit shown at Fig. 3 is a very clean-working tool,
and when fixed on the end of a saw spindle or lathe mandrel the work may be fed up to it at any speed. It
should be noted that the work of boring with a centrebit of larger diameter than 1½ in. is made much easier if the
bit has a second vertical cutter. The boring tool shown
in Fig. 4 is Intended for side-grain work only. It is adjustable in regard to size, and, within the limits of the
cutter, will bore circular holes of any diameter. It will
also do trenching, grooving, and surface sinking to any
pattern where a suitable mould is provided. This tool



with Glass.

stiles and rails. Then mitre round the opening with \(\frac{1}{2}\)-in. beading (which, if too wide, must be planed to breadth), fasten with sprigs, insert the glass, and secure the beads on the other side. The beading that is put on last is preferably fastened with screws, so that in case of breakage the glass is easily replaced.

Floorcloth Manufacture.—The foundation of floorcloth is a coarse jute or hemp cloth filled and stiffened with gelatinous substances, such as glue size, potato starch, etc., and subjected to powerful calendering to get a smooth even surface. It has then much of the appearance of hrown huckram, but of a more clastic feel. The hody colour is then laid on, which consists of heavy mineral ochres, paint manufacturers' tailings, and lead oxides, ground up with linseed oil and driers. The hody colour is run from the mixing pans into a trough, which can be adjusted to a more or less inclined position, and the overflow falls on to the cloth which is passing underneath; it then travels to a set of spreaders, then through a pair of soft felt-covered calender howls, and successively to papier-maché, hoxwood, and steel rollers. The cloth is then taken to the drying loft for the surface to harden, and is then given one or more coats of paint on both sides and again allowed to dry. The next process is the printing; this was formerly done by hand, which, however, has been superseded by a machine capable of printing twelve separate colours in one operation. The floorcloth passes over a large wrought-iron drum, which has around its periphery twelve engraved rollers, each having its own separate colour box and wipers, and capable of fine adjustment, the decorating being complete as the cloth leaves the machine. After drying, the surface is varnished and taken to a heated room to preventhlooming, and then the edges are sheared square by a machine

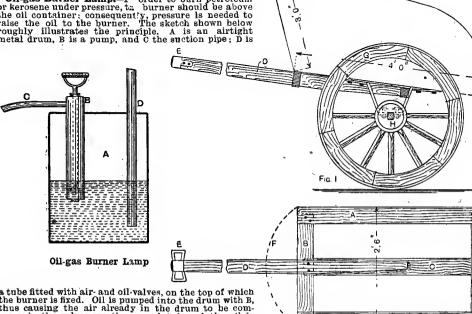
is chiefly used in connection with the "elephant" machine, but is equally well adapted for use on the lathe. There is an element of danger, however, in its use, as it is not provided with a centre point, and therefore, when running at a high speed, is liable to do considerable damage, unless the work is fed in a regular manner and held down with absolute security. In the drawing a universal chuck is shown attached to the head of the bit. Fig. 5 shows an American reamer, a tool specially made for ladder makers and wheelwrights. It is stocked in all sizes from \(\frac{1}{2}\) in. to 6 in. at the large end, and may be had either with long or short tapers. The larger sizes are for reaming out the hub blocks of wheels, ready for inserting hoxes. The same bit is made in all sizes up to 6 in, but with parallel sides, for straight horing. Fig. 6 shows a twist bit of special value to wheelwrights, having shoulders at the large end adapted for cutting recesses to suit various styles of boxes.

Filling Cracks in Artificial Leg.—A good filling for cracks and uneven places in an artificial leg is white-lead putty; this is ordinary putty mixed with sufficient white-lead to make it soft. Scrape the crack clean, rub some white-lead well into the crevices, then fill in with putty and allow it full time to get hard before covering the spot with leather. The leather used in covering artificial limbs is very thin and light, similar to that used by bookhinders, but dyed pink or brown instead of purple or black.

Removing Colonr from Meerschaum Pipe,—A meerschaum pipe which has coloured unequally through lying on one eide may have the greater part of the colour removed by steeping it for some time in moderately strong ammoula solution, 1 part of strong ammoula to 2 parts of water.

Ventilation of Bedroom.—A chimney in good working order is the best extractor of vitiated air that could be wished for; ascertain, therefore, whether the chimney of the bedroom fireplace has in it an active and constant up-draught. Ascertain next whether plenty of air can enter the room. Air usually enters a room through the fissures around and under the door and the windows; and unless draught-stopping has been used, the air that enters a room in this way is considered ample for a bedroom occupied by two persons. The air that enters the room should be pure and wholesome; in ordinary residences most of the air enters the room by the opening under the door, and usually this air is considered sufficiently good for ventilation purposes. Perhaps the safest remedy is (provided the chimney has in it a proper draught) to fix a 9-in. by 3-in. Tobin's tube ventilator in the outer wall of the bedroom. The best air, and as much as is required, will then be obtained. The entry of air into a room is wholly dependent on the extracting qualities of the chimney; new air, therefore, cannot enter a room if none of the air already in the room passes out. room passes out.

Oll-gas Burner Lamp.—I order to burn petroleum or kerosene under pressure, taburner should be above the oil container; consequently, pressure is needed to raise the oil to the burner. The sketch shown below roughly illustrates the principle. A is an airtight metal drum, B is a pump, and C the suction pipe; D is



a tube fitted with air- and oil-valves, on the top of which the burner is fixed. Oil is pumped into the drum with B, thus causing the air already in the drum to be compressed; the valves are then regulated, and the oil is forced up to the burner, vaporised, and burnt. A pressure gauge should be attached, and the apparatus should be worked at about 18-1b. pressure. Great illuminating powercan be obtained from lamps constructed on this principle, but the light depends on the size of the burner, which is made of cast-iron.

Care of Billiard Balls and Tables.—When billiard balls jump the pocket the cause often is to be found in some slight unevenness in the covering of the table bed leading to the pocket, or the table may be out of level. Of course, the trouble may be due to the player or the ball may be foul. To test a ball, place it in baulk and strike it with sufficient force to cause it to run twice up and twice down the table; if the ball whilst running makes a sort of rattling noise it is a foul ball, and instead of being a perfect sphere inclines slightly to the shape of an egg. After the balls have been in use for some time and have been subjected to a great deal of knocking about, the ivory not only becomes seasoned but also expands unequally, so that the balls are no longer perfect spheres. They can then be sent to the makers to be re-turned. An excellent plan to preserve billiard balls is to bury them, when play is finished, in sawdust saturated with sweet oil. Apparently the oil is taken up by the ivory and compensates for the effect of the heat of the day. Heat is a great destroyer of the accuracy of billiard balls that are true. To test the accuracy of the cushions, they should be looked at from a point in the prolongation of the cushion, and if the edge is not a perfectly straight line they are not true; either the rubber has come away from the foundation, or the cloth has been pulled tighter in some places than others.

To test whether a table is horizontal, use a long spirit level, which should be placed on the hed of the table in various directions and reversed; if the air bubble in the level remains in the centre under all conditions, the bed may be considered true. The cloth covering of the bed requires special and constant attention, and should be kept carefully clean by brushing followed by ironing.

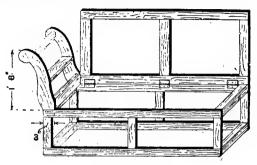
Roman Charlot.—Fig. 1 is a side elevation of a Roman charlot for use in a carnival; Fig. 2 is a plan of the bottom framing drawn to a scale of \(\frac{1}{2} \) in. to the foot. For the bottom frame thoroughly dry English ash should be used; the two bottom sides A (Fig. 2) are \(\frac{4}{1} \) ft. long by \(\frac{3}{2} \) in. wide by \(2\); in. deep; the two cross bars B are \(2\) it. long by \(\frac{4}{2} \) in. wide by \(\frac{2}{2} \) in. it he centre bar C is \(4\) in. wide by \(\frac{2}{2} \) in. deep, and framed as shown.

Fig. 2 Roman Chariot The pole D (Figs. 1 and 2) is 9ft. long by 3½ in. square, tapering towards the front to 2½ in., and a pole crab is fitted as shown at E. The sweep at the front of the body is indicated by the dotted line F (Fig. 2). The bottom hoards are 1-in. elm, the grain running across the body. The wheels G (Fig. 1) are 3 ft. high, the felloes 3 in. square, the diameter of stock is 8 in., and the length of the stock 9 in. The spokes, twelve in number, are 2½ in. The axle H (Fig. 1) is 1½ in. square, and is fixed to the iron stay. The distance between the flap and collar is 2 in., and a common grease axle is used, having right-and left-hand threads and a linch pin. The body should be painted yellow, picked out in blue, and the wheels red, picked out in black. The sides and front may be of canvas, and battens will have to be put in the body to keep it in shape. The pole will have to be fitted with two whiffle-tree bars, and the harness will consist of hridle, breast strap and pad, crupper strap, and reins.

Bending Walking-stick Handles. — The handles of hazel sticks may be bent either at first, when the sticks are fresh cut and when heat only is necessary to effect the bending, or after they have been stored and dried. In the latter case the part to be bent must be placed in boiling water until it becomes pliable, or else (where there is a danger of staining the wood) it must be subjected for a long time to the direct action of steam. There is less danger of the bark peeling away at the bend when the sticks have been stored for a year than when the sticks are bent fresh. Before the binding or frame is taken off the sticks should be dried in an oven.

Scratch Knots.—Scratch knots in any size may be made with a machine for whipping large cables with copper wire. The principles of construction are similar to those of a gimp-making machine. The strands of brass wire pass from bobbins of the required number through a pipe, and are whipped with copper wire as they emerge from the pipe; then the whipped cable is wound on a drum. To form the scratch knots, this cable must be marked off in divisions of the required length, and a speck of soft solder must be secured to the whipping wire lin. each side of each division, to prevent unravelling when the cable is cut. The division marks must next be cut through with a fine circular saw, and the loose ends of the whipping wire cut off, or secured by solder as required.

Ottoman Couch.—The illustration shows the complete framework of an Ottoman box-couch. The principal measurements are, total width, 2ft.; length, 5ft.; height of box portion, 1ft. 3in.; height of arm, 1ft. 8in.; seat lid, 4ft. 9in. long by 2ft. wide. The carcase is made of 1½ in. by 2½ in. stuff, with mortised joints, the bottom being covered with matched boarding. The scroll arms are made of 1½ in. stuff, 3in. wide at the bottom, with a rake of 5in.; these arms are framed up to 2ft. wide over all by housed cross rails and foot rails, and secured to the carcase by dowels at each side. The seat lid side rails are made of 1½ in. by 1½ in. stuff, and the cross pieces should be 3in. wide, mortise-jointed, and hung on three wrought-iron butts. Plate castors should be fixed at each corner. The whole of the open spaces should be cross-webhed and covered with hessian. The stuffing (which can be a light mill-puff) should be strung



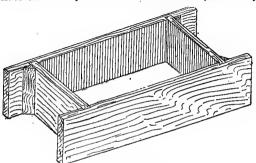
Ottoman Couch.

on the sides, ends, and arm to a fulness of about 1½ in. The seat will require stitching up to a firm square edge, as also the edges of the scrolls. Printed pique, cretonne, or cotton tapestries will be a snitable covering, the borders being set off with a coloured cord. Line the inside with sateen or Roman satin.

Bolian Harps.—Æolian harps usually are made the length of the window at which they are to be used, as the object should be to prevent air passing in without going over the strings. A twelve-stringed harp which is of convenient size, as it will do for several windows, is 32in. long, 5in. hroad, and 3in. deep (outside measurements). If this is not long enough for any particular window, cut a piece of board about 3 in. longer than the vacant space and the width of the side of the harp, and fix the board by a screw to the side of the harp, so that when not in use it will turn back and lie snug along the side. For the bottom of the harp use \$\frac{1}{2}\$-in. pine for the sides and belly, and heech for the blocks and bridges. Begin by getting out the bottom, \$\frac{1}{2}\$-in. wide; on the outside edges of which glue and head on the sides. Fill np the right-hand end with a wrest-pin block \$\frac{1}{2}\$-in. po observing that the grain of the blocks runs the same way as the box. These blocks must he very accurately fitted, after which glue and cramp them in place, then dress the tops flush with the sides. In the centre of the belly is cut a sound hole \$\frac{1}{2}\$-in. in diameter (if the harp is made longer than 32in., two holes may be cut at a distance of 9in. from the ends), and, after careful fitting, it can be glued and cramped on top of the box. A wind board, to ensure that all wind passes close to the strings, should be made of \$\frac{1}{2}\$-in. stuff of the same sizes as the harp, and having end pieces \$\frac{1}{2}\$-in. glued on so that the board stands \$\frac{1}{2}\$-in. position, and at the sams time making it easily removable for tuning, etc. The two bridges are made of beech \$\frac{1}{2}\$-in. high, \$\frac{1}{2}\$-in. wide at the base, and tapering to \$\frac{1}{2}\$-in. at the top, the length, of course, being

the width of the harp. The holes for the wrest pine can now be hored at 14 in. from the right-hand end (that having the longest block). Drawa line across the harp, and on this line bore holes to fit the pins at a distance of about \$i\$ in. from each other, the first hole to be about \$i\$ in. from each other, the first hole to be about \$i\$ in. from each other, the first hole to be about \$i\$ in. from the front edge. One inch in advance of this line bore another set of holes, coming exactly between those of the first row. Note that these holes should be bored at an angle of about 20°. At the other end mark off corresponding positions for the hitch-pins, after which clean up, stain, and varnish, or finish to fancy. When dry, the wreet-pins can be inserted and hitch-pins driven in, leaving \$i\$ in. outside. The harp is now ready for stringing up, the strings used being first-violin E gut strings; care must be taken that they gauge exactly the same size. When all the strings are on, place under them the bridges at 2 in. from the pegs at each end, and proceed to tune. The best results are obtained from a low pitch, and the strings should all be tuned to a low pitch, and the strings should all be tuned to a perfect unison. As a rough gnide for the pitch, try C in bass clef, but it will be as well to experiment with several notes, observing which gives the best results When it is desired to use the instrument, place the wind board over the strings, stand the harp on the window ledge, and pull the sash down close to the top of the wind board, so that air cannot enter the room without passing over the strings; sometimes the door has to be opened to get sufficient draught.

Mould for Brickmaking.—The moulds for making bricks by hand may be constructed out of \(\frac{1}{2} \)-in. deal and lined with sheet zinc. The ends are housed into the sides and nalled, and blocks at the corners, as shown,



Mould for Brickmaking.

will add to the life of the mould, which is open at the top and bottom. The inside dimensions vary slightly, but the orthodox brick is 9in. long by 4½ in. wids and sin. thick. The allowance for shrinkage of the clay in drying and burning is usnally from 10 to-15 per cent., so that the mould will require to be made correspondingly larger. In use, a lump of the tempered and plastic clay is cut off by a lad, rolled in dry sand, and handed to the moulder who has previously sprinkled the inside of the mould with a handful of dry sand to prevent the clay sticking. The clay is then pressed in, the surplus struck off with a flat wooden paddle, known as a "strike" or "strickle," and the brick turned out on to a flat board called a "pallet," a little larger than the brick. On this the brick is taken away to the hacks to be air-dried.

Removing Broken Dowel Screws from Umbrella Handles.—The best plan whenever possible of removing broken dowel pins from umbrella handles, sticks, etc., is to cut off a small portion of the handle so as to expose the broken end of the screw, which can then be fixed in a vice and twisted out. Falling this, the screw can be drilled out with an ordinary Morse drill in the lathe. A special drill for drilling out broken screws is formed of steel tube, and lets the broken screw pass up the centre.

steel tube, and lets the broken screw pass up the centre.

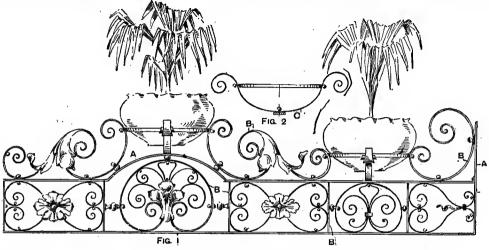
Removing Brazing Marks from Silver.—Solder will run away from a part of a joint instead of running into it when the edges of the joint have been imperfectly cleaned preparatory to the application of flux and solder; also, if some dirt has got into the flux, or on the pallions of solder employed. Another cause is unequal heating of the joint, or allowing it to expand too much whilst being heated. The resulting fire marks may be removed by warming the articles on a pan over gas, and plunging them whilst warm in a pickle composed of sulphuric acid 1 part, water 10 parts. Or the marks may be removed in a hot and strong solution of potassium cyanide, and the polish renewed by a light polishing with a revolving swansdown mop and rouge composition.

Copper Sulphate.—Large quantitles of copper sulphate are prepared by roasting copper pyrites (a double sulphide of copper and iron), whereby oxides of copper and iron are produced and sulphurous acid is given off. The latter is converted into sulphuric acid in the leaden chambers. The roasted mass is heated in leaden pans with sulphuric acid and steam, and the sulphate of copper is obtained by crystallising out. If a purs sulphate is required, the first crystals are dissolved in a little hot water, the solution evaporated, and then allowed to cool, when the pure sait separates out. Copper sulphate is also produced directly by carefully roasting copper pyrites. The roasted material is treated with water and the sulphate of copper obtained by evaporation as above described. After separation of the greater part of the sulphate of copper by crystallisation, there is still a portion left in the impure liquor. To recover the copper from this liquor, iron plates are placed in it, and these precipitate the remaining copper in the form of a fine powder, which, after washing, is also dissolved in sulphuric acid.

Window Flower Stand in Iron.—Window fern or flower pots help to give an air of freshuess to a house and to relieve the monotony of bricks and mortar, and the effect is enhanced when the flower pots are supported in an ornamental wrought-iron stand. The design must, of course, depend largely on the size of the

cut in line with the wires. Take a rubbing of the bridge on stout paper with heel ball, but be sure that it is a clear imprint showing the flat face, bevels, and pin holes. Next with a sharp chisel lift up the portion to be removed, and cut off a portiou, or send the whole piece with the paper imprint to ensure having the new piece of the same thickness. Fit the new piece into rosition, and hore and countersink holes for flat head brass 1-in screws. Bore holes between the string spaces not to interfere with the bridge pins, and then make secure with hot glue, the bearing surface being perfectly free from varnish, old glue, or remnants of the old bridge. Next day tap the bridge pins home till their project in full, then with a flat file level down on a line with the others, put on new wires, and pull up the tension gradually till they sound fairly well in tune.

Painting Tarred Surfaces.—The difficult task of obliterating tarred surfaces with ordinary paint is never accomplished successfully. The work, after being painted, dries out with the characteristic brown stain due to the penetrative action of the constituents of the coal tar, phenol, light oils, etc. Shellac knotting, of which two or more coats are applied, is used by the uninitiated as a cure, but this only acts as a temporary remedy, and in all cases, after a few months' exposure, the tar shows through the work in irregular brown patches. Many more or less unsuccessful remedies have



Window Flower Stand in Iron.

window sill; that shown at Fig. 1, however, may be adapted to any ordinary dimensions, but before starting work a full-size drawing will be necessary. The sections of metal are as follows. The frame A is l in, by $\frac{1}{4}$, in, the scrolls and uprights B are $\frac{3}{4}$ in, by $\frac{3}{4}$, in, and all the rest of the work may be $\frac{1}{2}$ in, by $\frac{1}{4}$ in, in a dall the rest of the work may be $\frac{1}{2}$ in, by $\frac{1}{4}$ in in a dark will of course, be beaten out of charcoal iron and screwed or bolted on with round-headed screws. The carrier rings for the pots are given extra support by the scrolls running back and front, a side view of such a scroll being given at C (Fig. 2).

Replacing Split Top Bridge of Piano.—Replacing the split top wooden bridge of a piano with a metal one would impart to the instrument a metallic tone quite different from the previous tone. Experiments have been made of inserting a small section of metal or stone bridge at the extreme treble end with the object of improving the tone at this point; but the idea is now discarded in favour of a brass pressure bar, which may be used whether the bridge is pinned or not. If the defective bridge is a pinned one, it should be replaced with one of similar construction, and in order that this can be accomplished, the steel wires must be removed from as much of the bridge as will be required to be cut away, and it will generally be found less trouble to restring with new wires than to attempt to use the old ones again. Before removing the wires, note whether the wire gauge marks are indicated on the plank, such as Noe. 13, 14, 15, and so on; these numbers give the size of the wires to the right of them, but if they do not exist, make a memorandum of the number of notes that go to each gauge of wire, and for this purpose procure a musle wire gauge. Then draw out the pins, and with a fine saw cut through the bridge where required, keeping the

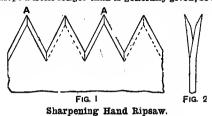
been tried. The following method, however, has been tested by the writer on many occasions, and has been found to give a permanent cure. The preparation here described is to be used as a medium with ordinary paint. Place in an iron vessel over the fire 3lh. of common restn. After it has melted, remove it into the onen air well away from any naked light or fire, and allow it to almost set—that is, to remain just in a liquid state; then stir into it 2pt. of solvent or coal-tar naphtba and pt. of boiled oil. Stir well together, when the mixture will gradually assume the appearance of oak varnish, and is then ready for use. Mix 1pt. of the medium with 7lb. of ordinary paste paint of the required colour, hut on no account use white-lead, which would turn into a thick unworkable mass. Use zinc white. This preparation may also be used as a preservative for damp walls, for both interior and exterior use, and for this purpose should be applied warm in order to penetrate into the pores of the hrick or stonework. It dries hard in about two hours, with a gloesy surface, which may be immediately papered or painted; that is, when the medium is used alone, without the addition of paint. There is no difficulty in making this preparation, and it may be prepared at a cost of 2s. per gallon, 1 gal. covering 60 sq. yd. of wood or brickwork.

Soundproofing Bedroom Floor.—To make a bedroom floor soundproof, remove the floorboards, and nail 1-in. by 1-in. fillets along both sides of the joists as close to the ceiling laths as possible without injuring the ceiling. Then get some \(\frac{1}{2}\)-in. rough boarding and cut in between the joiets, each end lying on the fillets already fixed; the entire length must be covered with boarding. Then fill the space between the boarding and the under eide of the floor with fine deal sawdust.

Destroying Moth in Plush-upholstered Furniture.

—Moth and larvæ in furniture come from the stuffing material, which becomes infected because it is unseasoned green fibre or through not being properly purified. Anything applied in a liquid form will destroy to a certain extent the nap or pile surface of the plush, and on the other hand a powdered insecticide will only destroy those moths which appear on the surface, leaving the eggs; etc., to cause further mischief. An effectual remedy in liquid form is made by dissolving 2 oz. of albo-carbon in 1 pt. of benzoline. Take the furniture out of the way of fires and naked lights, and sponge freely; the pile can be raised by holding a hot fiatiron close to it, and brushing up with a soft brush. Repeated sprinklings with powdered camphor or dry herb wormwood is also good. In the trade the goods would be put in a fumigating chamber and subjected to sulphur fumes.

Sharpening Hand Ripsaw.—The following method of sharpening hand ripsaws, though not generally adopted, answers well in actual practice. The teeth are filed alternately from opposite sides, as in the usual method, except that both edges of each tooth are hevelled from the same face, to form a long point at A (Fig. 1). In this way each successive tooth resembles a diamond-pointed wood chisel having a left and right cutting edge, but alternately from opposite sides of the saw blade. The set is that which is commonly given, the flat side of the pointed tooth being turned outwards alternately, as is usual (see Fig. 2). If the teeth be made slightly longer than would form an equilateral triangle, and also the side slope a little longer than is generally given, so as to

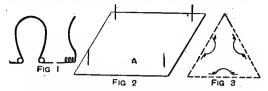


obtain a keener cutting edge, the saw will be found to cut much more sweetly.

wuriatic Acid.—Muriatic acid is simply a solution of hydrochloric acid, another name for it being spirit of salt, this having been suggested by the fact that the acid was formed by treating common salt. The acid occurs very little naturally, but, as a gas, is sometimes given out by volcances. As sold it usually has a specific gravity of 1.17, when it contains about one-third of its weight of gas, the remainder being water, of course. More exact figures, founded on some given by Ure, are as follows. A specific gravity of 1.17 corresponds to a percentage of hydrochloric acid gas of about 34, while for the proportion of 33 per cent. the specific gravity of the solution is 1.164, the temperature being 15.6. A saturated solution of hydrochloric acid in water has a specific gravity of about 1.21, the percentage of gas present being rather more than 42. The liquid fumes very freely in air, and as sold in the shops is usually of a slightly yellow colour, this being owing to the presence of free chlorine, ferric chloride, or, very often, iron. A simple method of preparing a solution of hydrochloric acid is as follows. A flask is supplied with a mixture of fused salt and oil of vitriol (sulphurle acid), and the open end of the flask is corked and fitted with a bent tube which joins it with two Woulfe's bottles, contains water in which the gas is condensed. A form of the special bottle required could be made by fitting a widemouthed jar with a cork in which three holes had been formed, these holes carrying plain glass tubes. Of these, the centre one dips into the water in the jar and the two others are bent outside the jar for making the necessary connections, but do not enter the water. In the second jar it is only the tube farthest from the flask had does not enter the water and it is, of course, this one that joins up to the third jar. All the connections may be made with vulcanised tubing. The first bottle should contain the least water, which is used to absorb any salt particles that may be carried over with the acid

salt, cannot be collected over water, in which it is obviously very soluble; instead, mercury must be used over which the gas is readily collected. Owing to the impurities in the oil of vitriol from which the muriatic acid is obtained, it very often contains, in addition to the foreign matters mentioned above, a number of others, such as arsenious and sulphurious acid, beside sulphuric acid itself. Further, arsenic and organic matters can also be found in it. These impurities are to be expected in the acid ohtained as a by-product in the manufacture of sodium carbonate (soda ash) by the salt cake process. The material being an acid, it follows that it contains hydrogen, and that this hydrogen can be replaced by a metal; this is perhaps an essential property to be looked for when deciding whether or not any particular material is an acid. It is not surprising therefore that muriatic acid will dissolve such metals as tin, zinc, nickel, and iron with which it forms chlorides, the hydrogen escaping, and it is obvious, therefore, that it must not be used continuously on engines, boilers, or similar machinery. It will be found, however, that hydrochloric acid will not dissolve pieces of platinum; this action will occur when nitric acid is added and the mixture, known as aqua regia, is warmed. regia, is warmed.

Boxes for Sending Eggs by Rail.—Below are instructions on constructing the inside wire fitting for a box for transmitting about four or six dozen eggs by rail. The wire interior is made of No. 18 B.W.G. steel wire (shaped as Fig. 1 which shows both front and side elevations) this is soldered to a piece of stout tin XXX charcoal plate A (Fig. 2) about 6 in. by 8 in. This



Fittings of Boxes for Sending Eggs by Rail.

will hold twelve eggs. As many of these metal stands as required can be put into a wooden case; therefore, to despatch six dozen eggs, six metal stands placed one stand over another would he required. Three-inch pieces of No. 8 B.W.G. wire are fixed in the corners of the metal stand, as shown in Fig. 2, to support the stand which is placed over it, and which contains another dozen eggs. Three wires twisted as Fig. 1 and placed triangular fashion as indicated by Fig. 3, hold each egg; thus, thirty-six wires and four uprights will be necessary to carry each dozen eggs. carry each dozen eggs.

thirty-six wires and four uprights will be necessary to carry each dozen eggs.

Cleaning Cuckoo Clock.—A cuckoo clock is a most difficult clock to clean properly; indeed, valuable cuckoo clocks have been entirely spoiled by having been tampered with by inexperienced persons. To do the work, commence by drawing out the pin and then unscrew the brass nut that holds the hands; remove these, then the four pins that holds the hands; remove these, then the four pins that hold the dial in place, and the two doors, and draw out the wire nails holding the back to the movement. This will then be clear, and the small door opened and closed by the bird being removed, the works should be well studied. Note how the bird is sent out and how the tilting motion is given to cause its mouth to open and its wings to spread. The slender wire fixed to the left-hand bellows does this, and a lever near the bottom of the rod on which the bird is fixed causes it to go out, calling "one" "coo," and theu allows it to return. A rough sketch of the various parts will help in putting the whole together, because, unless the five lever bars at the left-hand side are in their proper places, it will all be out of order. The lowest har has a wire upright which lifts the right-hand bellows, the next lifts the other bellows, and the bar above is the hammer to strike the gong which accompanies the bird's calls. Another lever counts on the count wheel the number to be called, etc. The difficulty lies in this mechaulsm, but after study it may be managed. Use a thin piece of card to clean out the dust which will have accumulated in the cap part opposite the lips of the pipes. The going part is like that of all other clocks, and so need cause no trouble. Replace the chains, then fix on the back with the gong attached and the dial, making the hands agree with the hour struck, and replace the small door on the front part with wire attached to the pedestal of the bird. Oil all the pivot holes, giving a drop to each and to the tips of the bars and each pall

Blueing Spectacle Frames.—To blue spectacle frames after brazing, clean up with the finest emery cloth, and if the frames require re-blueing in one spot only, warm them very gently over the fiame of a spirit lamp, watching the colour change and leading the blue along the frame. This requires quickness and skill. If the first attempt is a failure, clean off and try again. To blue the frames all over is more difficult, and is done by opticians in hot charcoal dust. A heap of this is placed in an iron pan or a shovel, and is then ignited by a blowple, or by placing the pan until it becomes partly redhot over a gas hurner. When the charcoal dust begins to glow, stir it up with a metal rod and blow it gently till it is all glowing and smouldering. Then insert the spectacle frame, stir it about for a moment and withdraw, watching the colour, and repeatedly inserting it until correct. Further instructions on blueing articles of steel are given in Series II., pp. 32 and 89.

Hot-air Flue and Water Circulation in Incubator.—The hot-air flue may be a straight piece of copper pipe about 2 in. in diameter carried through the water in the circulator and reaching from the bottom of the circulator to the top; about 1 in. from the top of this pipe the hot-air flue is taken off, and is carried round inside the tank and through the water. The circulator itself has at the top of its side a 3-in. hole. A piece of copper pipe 3 in. in diameter and about 4 in. long is fixed over this hole; a 3-in. hole is cut in the side over the hole in the tank, thus allowing 1-in. space hetween the outer and the inner tubes. Water, when heated, naturally rises to the highest point; therefore the hottest water in the circulator flows into the tank through the upper portion of the 3-in, outer tube. The cold water in the tank now comes back through the



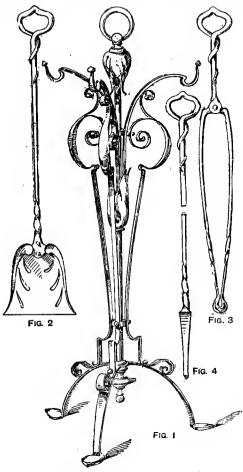
Hot-air Flue and Water Circulation.

hottom part of the 3-in. outer tube, and so circulation is maintained in this manner all the time the lamp is alight. As the water is constantly on the move, cold water cannot be found in any part of the tauk. For a detailed sketch of the circulator, see the accompanying illustration. The top of the circulator must be domed as shown, and an air-tap placed at A, the highest point, which will he about the centre of the dome. If the water becomes air-locked, circulation becomes impossible; this tap must therefore be left open when the apparatus is heing filled, and also when the apparatus is relemished. The top of the tank should also be the highest point, and there also an air-tap should be provided.

Repairing Broadwood Table Piano.—In the case of a Broadwood table piano in which several hammers are broken, observe the following hints in removing the action for enabling the old coverings to be taken off. The key-board and hammer action is self-contained; and is sometimes in two sections, the largest portions extending from the extreme bass end to a support for the sound-board. This forms a division extending from the sex made from the piano, and the smaller portion extends from this division to the sound-board to the base board or floor of the piano, and the smaller portion extends from this division to the extreme treble end. Dampers are attached to the larger portion only. The hammers and hammer levers are hinged on rails supported on standards fixed in the ends of the key frame. To withdraw these, take out the maker's name-board by pulling upwards; it slides in a channel at each end. Next remove a thin slip of wood that fits into a groove immediately in front of the keys. This is rarely screwed in, but fits tightly; but if necessary, prize it up with a chisel or the point of a screw-driver. The larger portion of the key-board should now pull forward, and should be taken right out before withdrawing the small portion. The hammer stems are in two sections, the longer part, to which the hammer head is attached, being vellum-hinged to a short section which is gland to the hammer rail. A thin strip of mahogany is generally screwed over these short sections for greater security and to give a neater appearance. If the felt covering of the hammer heads is so hadly worn as to need re-covering, it will be more satisatory to re-cover the whole set; for this purpose a cheap hammer felt will be quite suitable. The old covering felt only) and vellum or leather hinges can be readily removed by softening the old glue by pressing a strip

of hot flat iron against it. When re-covering the hammer heads the felt will require bevelling along the edges, and the portion covering the tip of the hammer head should be left untouched by glue. Bind tightly with tape, securing the two ends of the felt at one operation. Vellum or leather for hinges may be procured in small quantities, or the requisite material in calf leather can be stripped from the cover of an old account book; if vellum is required, a piece of old banjo head will do.

Wrought-iron Fireirons and Stand.—The custom of resting the fireirons on dogs is being replaced by the fashion of hanging them on a stand placed on one side of the chimney corner or hearth. Fig. 1 is a design for a



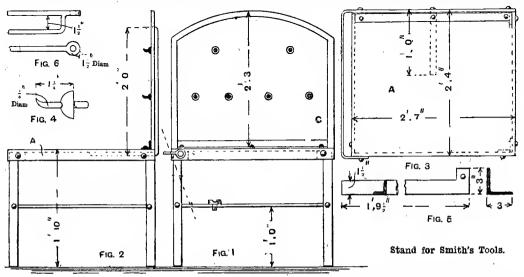
Wrought-iron Fireirons and Stand.

stand, fairly simple in character and suitable for execution in wrought-iron, and it would look very well indeed if finished "armour bright." The fireirons (Figs. 2, 3. and 4) would be better if specially made, and designs are given; hut if preferred they may be bought and simply provided with riugs at the top to suspend them from the stand. The feet of the stand should spread sufficiently to prevent it being easily upset.

Uniting Rubber Tube to Vulcanite Tube. — To join a niece of vulcanite tube to a piece of indiarubber tube, adopt the method described below. If the tubes are of the same size, the junction should be made by a short piece of brass tube, the outer diameter of which is equal to the inner diameter of the tubes; the tubes may be wired on for further security. If the vulcanite tube is the larger of the two, the joint may be made with a tapering brass tube; but if the rubber tube is the larger, it may be drawn over the vulcanite tube aud, if necessary, wired. In all of the cases described above the joint would be quite waterproof.

Stand for Smith's Tools.—Figs. 1, 2, and 3 show the elevations and plan of a useful stand for a smith's tools. The top A (Figs. 2 and 3) may be a piece of an old surface plate cut to the dimensions given in Fig. 3. Otherwise, the top may be cast, or can be made from ½-in. plate with three pieces of 2-in. angle iron riveted on for strength In any case, a light cut should be taken over it in the planing machine, as it is then of use for levelling light work. The back is of ½-in. sheet iron cut ½ in. short to allow ½ in. at each side for the thickness of the angle iron stiffening o (Fig. 1). This is made from light L-section, say I in. by ½-in. by ½-in., and is bent to the shape of the back plate, to which it is secured by ½-in. countersunk rivets. The position of the small hooks (for hanging callipers, etc.) can be seen in Fig. 1, and a detail drawing of a hook is given at Fig. 4. The back is secured to the table by a bracket of 1½-in. half-round iron shown in Figs. 2 and 3. This should be riveted to the back, and bolted to the under-side of the table by countersunk bolts. For further security a piece of 1½-in. by 1½-in. angle iron is bolted with ½-in. bolts in the position shown in Fig. 2, the flange extending round three sides of the table only, the back being bare. The legs (Fig. 5) are made from 1½-in. angle iron, and may be without the lugs shown on the end, but the job will not be nearly so

and olive greens may be produced. Chrome greens may be tinted in a similar manner to the brunswick greens. Emerald green may be lightened with white-lead or chrome yellows and deepened with brunswick or Prussian blues. Chrome and zinc yellows may be lightened by the addition of white-lead and zinc white and darkened with orange chrome, yellow ochre, raw sienna, hurnt sienna, and the umbers. Yellow ochre may be lightened with chrome yellow and white-lead, and deepened with raw sienna, raw and burnt umber, vandyke brown, oxides, Indian red, and drop black. Vermilion may be lightened by adding white-lead, zinc white, orange, and red-lead, and deepened with carmine, madder red, and most other pigments without carmine, madder red, and most other pigments without being chemically affected. Venetian red and the oxides may be lightened with white-lead, zinc, red and orange lead and vermilion, and deepened with Indian red, burnt sienna, purple brown, blue, and ivory black. Indian red may be lightened with red oxide, white-lead, signal red, and deepened into a chocolate or brown by the addition of ivory black or drop black in variable proportions. Brown pigments as raw and burnt umbers may be lightened by the addition of white-lead, zinc white, yellow ochre, and orange chrome; almost any shade of grey or drab may be produced by mixing



strong. Holes should be drilled in the lugs for \$\frac{1}{2}\$-in. bolts. Figs. 1 and 2 show, about half-way down the legs, two tool racks for bottom tools. These are placed one at the front and one on the right-hand side, and are made from \$\frac{1}{2}\$-in. square wrought-iron, the ends being welded and bossed as shown at Fig. 6. The racks are held in position by \$\frac{1}{2}\$-in. bolts. Figs. 1 and 3 show a single rack on the left-hand side; this is for holding setts or top tools, and is made from \$\frac{1}{2}\$-in. square iron with an eye turned on each end large enough to slip over the leg bolts, which must, of course, be long enough. Note that the rack is not on a level with the table, for by putting it lower the handles of the tools are caused to cant as shown by the dotted line in Fig. 1, and this keeps them out of the way of the smith's feet.

Tinting Colours for House Painting.—The colours named of which notes are given below are so arranged, when mixed, as to be permanent in ordinary circumstances when used in house painting and decorating. White-lead, which is the principal pigment employed by the house-painter, may be mixed with nearly all colours with the exception of those containing sulphur, as lime blue, ultramarine blue, and cadmium yellow. Zinc white may be mixed with all other pigments. Its want of body or covering power is its chief objection. Ultramarine, royal, and lime blues may be compounded with zinc white without the colour being affected. Brunswick or celestial blue, which is of a deep shade, may be prepared in a variety of pale and intermediate shades with the addition of whitelead, and may be deepened with Prussian blue or drop black. It should not be compounded with ultramarine blues. Brunswick greens may be lightened with lemon chrome or deepened with brunswick and Prussian blues; with the addition of lampblack, umber, and yellow ochre in variable proportions, sage, bronze,

in variable proportions. Brown pigments may be deepened by the addition of drop or tvory black. The above are given in most cases without the addition of black, as this deadens the tints somewhat. Black may be added if required without chemically affeoting the pigments.

organis.

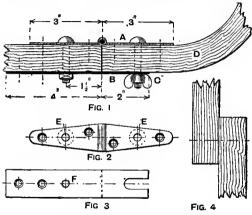
Cleaning Horsehair.—The following is the method of thoroughly cleaning horsehair adopted in the cleaning mills. The hair is placed in a large wire cage, which is put into a steam jacketed boiler. Water is then pumped into the boiler, the boiling lasting about half an hour. The cage is then removed to a hydro-extractor, also known as a "whizz," the hair being dried by high speed centrifugal action. The hair is passed once or twice through the teasing machine and is then ready for use. Doubtless a modification of the above process may be made to suit the amateur's requirements. New horsehair in the natural state goes through exactly the same process before being placed on the market for stuffing purposes.

purposes.

Thinning down Carriage Varnish.—To thin down lad of old carriage-body varnish that has gone rather stiff, and dries very slowly, adopt the following method. Place it over a gas stove or ring, and warm the varnish slightly until it becomes of a thin nature, and add to it into the place strong terebine, ipt. of pale gold-size, and about ipt. of American turpentine. Allow this to remain over the stove several minutes, continually stirring. Then remove it, and allow to cool down; use it in the ordinary way. The materials added to the varnish should be pale and of good quality, otherwise they will darken the varnish and make it unfit for delicate colours. The quantities of gold-size and terebine stated above should not be exceeded, otherwise the varnish is liable to deteriorate in durability and to crack when used on outside work.

Softening Snake Skin.—To soften a snake skin, damp the skin in salt water till it is soft, and with a blunt knife scrape off all the fat and fiesh; to do this, the skin should he placed on a circular piece of wood. Then make a solution in 4 oz. of water of loz. of alum and as much salt as the water will contain. For dissolving the alum the water must he hot. When cold, immerse the skin in this, and let it remain for fortyeight hours; it will then be cured. Now remove it from the alum bath, well pull it about, and stretch it out well, nailing it on a board to dry.

Folding Shafts for Mailcarts.—Fig. 1 shows in side elevation one shaft of a mailcart. So that it may fold, the shaft is cut snd fitted with a hinge A at the top and a plate B at the hottom, so that, by taking off the fly nut c, the portion D of the shaft can be swung back out of the way when necessary. The hinge shown in plan by Fig. 2 is 6 in. long, the width at the ends being ahout \(\frac{1}{2} \) in. The width at the crite should be equal to the width of the shaft at that part. The four countersunk holes take the fixing screws, and two holes E, \(f_0 \) in. in diameter and \(\frac{1}{2} \) in. from the centre, take the bolts (see Fig. 1). The plate B is shown in plan by Fig. 3, and it is 6 in. long and \(\frac{1}{2} \) in. thick, and is equal in width to that of the shaft. It has two countersunk holes, and a hole F, \(f_0 \) in. in diameter, for the left-hand bolt (see Fig. 1). At the right end is a slot \(\frac{3}{2} \) in. wide and 1 in. long, in which the bolt at C slides when the shaft D is let down. The plate B is fixed at the bottom so that the dotted line in Fig. 3, which is 2 in. from the end, lies under the joint, \(\frac{3}{2} \)-in. bolts and nuts heing inserted as shown. All the fittings look hest if made of brass. Another method of accomplishing the same object is to place the shafts as shown by Fig. 4, and hold them fast by a holt and fig nut



Folding Shafts for Mailcarts.

through the centre. This simple method, however, has several disadvantages. In the first method there is a tendency for the shafts to be less rigid, in which case an extra stiffener could be put in near the handles.

extra stiffener could be put in near the handles.

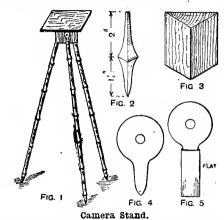
Attering Benzoline Blowpipe to Burn Paraffin Oil.—A hurner constructed for use with benzoline cannot easily he converted to a paraffin hurner. The two most important points to be considered in the atteration are that the tubes in which the oil is converted to a gas must be so arranged that they are subjected to a higher temperature for use with paraffin (owing to the vaporisation point of paraffin being higher than henzoline), and the inlets in the flame tube or ring through which air passes to mingle with the vaporised hydro-carbon must be larger for paraffin than for benzoline. The cheapest method of conversion would be to huy a new burner of the power required for use with paraffin, and attach this to the supply tube of the lamp.

Setting Out Buttoned Upholstered Work.—The standard size for a finished diamond-shaped tuft is 7in. by 5½ in., and usually this would be set out on the material or skin as 9 in. by 7½ in., thus allowing 2in. in length and 1½ in. in breadth for fulness. No hard and fast rule is observed, however, as if extra depth is required, 2½ in. would be allowed, depending on the materials used. To set out, lay the skin on the hench, and mark the outline of the seat. Always have the neck portion to the hack when covering seats. Mark out a centre line, and from this mark parallel lines 7½ in. apart; cross-mark these lines with spaces 9 in. wide, and the

diamonds can then be marked in and creased, setting them in by lightly hammering on a lap iron. No huttons should come any nearer than 2½ in. or 3 in. from the seat edge. In working common roans, it is necessary to glue small pieces of calico or leather clippings underneath the joints of the diamonds to prevent the twine cutting the skin when tying down. Commence by tying down the centre hutton, and fill up each tuft to a good swell, and keep the plaits as deep and tight as possible. The plaits at the edges must lie square with the edges, and he tacked to the stuffing rail. In setting out deep tuftings for curved work, it will he necessary to allow double the fulness given above, on account of the curve being quicker and the surface larger after heing stuffed.

being quicker and the surface larger after being stuffed.

Camera Stand.—Fig. 1 shows a light, cheap, camera stand or tripod, constructed for the special purpose of supporting a hand camera whilst photographing architectural subjects. To construct it, obtain three hamboo rode, all about 4 ft. long, and cut them in such a manner as to obtain a joint at the ends, which will eventually he nearest the ground when the stand is in use. Next get three pieces of iron, about \(\frac{1}{2} \) in square and \(3 \) in long, and draw each into a spike as shown in Fig. 2. Fix an iron spike into each rod; the joint prevents splitting if the spikes are driven carefully. The portable head is of wood, and Fig. 3 shows a triangular prism, which measures \(\frac{1}{2} \) in each way, and which is preferably of haywood, as it is light and holds screws well. On the top of this prism fix a piece of board of such a size as will easily support a hand camera; a piece \(\frac{1}{2} \) in thick is used to support a quarter-plate camera. To fix the rods, take three pieces of hrass tube, \(2 \) in. long and of such a diameter as to allow the rods to fit without having to pare the ends, say \(\frac{1}{2} \) in. internal. Next cut out three pear-shaped pieces of sheet iron, \(\frac{1}{2} \) in thick, as shown



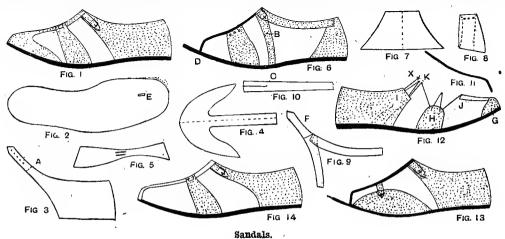
in Fig. 4, and drill a hole in each piece. Now the brass tubes should he taken, and one end of each squeezed flat for ahout \(\frac{1}{2}\) in. in a vice, leaving just sufficient room to allow the narrow end of the pear-shaped pieces of iron to enter ahout \(\frac{1}{2}\) in. Clean the iron and brass, and firmly solder them together, as in Fig. 5, using killed spirits and a rather hot hit, which will cause the solder to flow into the inside of the tube and thoroughly sweat the two pieces together, the superfluous solder being wiped away with a cloth. Screw a piece of tube to each side of the triangular prism of wood, so as to allow them to move in the same plane as the side to which they are fixed, insert the hamboo rods, and the stand is complete. It may quickly be set level by the legs, sighting over the top of the hoard, and bringing it in line with a string-course, window head, or any other horizontal line of the building. By pulling the head away from the rods, the stand is very portable, for the head can be put in the pocket, and the rods kept together hy two indiarubher rings. The weight of this stand complete would he between say 11b. and 21h., according to the size.

Crimson and Green Dyes.—For 10gal. of red dye

Crimson and Green Dyes.—For 10 gal. of red dye to be used for worsted, holl 41b. of cochineal with 2 gal. of water and strain, then add 34 lb. of quercitron extract, 3½ lb. of oxalic acid, 1½ lb. of cream of tartar, and 8 lb. of chloride of tin solution. The worsted may be placed in this solution cold and heated to boiling for one hour, For 10 gal. of green dye, tske 5 lb. of sulphate of indigo, ½ lb. of picric acid, 15 lb. of alum, and 5 lb. of sulphuric acid, and mix with water in a wooden vat. The worsted, after heing dyed, should be washed several times in cold water to remove excess of colour, etc.

Sandals.—The designs in sandals here given will form a groundwork for almost any shape desired. Fig. 1 shows a capped sandal, and is perhaps one of the best forms, as there is not much chance of the toe tripping with it. Fig. 2 is a sole shape, the full outline of which is the best shape for such work, but modifications can be made as shown by the dotted lines. The parts of patterns for this sandal are illustrated in Figs. 3, 4 and 5. Fig. 3, for the outside quarter, can be cut only to the line A, as the buckle goes here and the other piece forms the strap. Fig. 4 can be cut on the double, like a toecap pattern, and the same applies to Fig. 5 also, but one side must be wider than the other for the outside joint. This sandal could also be cut with the back as shown in Fig. 6, which may he with or without the centre strap B. The parts of this sandal are illustrated in Figs. 7, 8, 9, 10, and 11, Fig. 11 being Fig. 10 folded from the point C, and ready to be placed and sewn in a slot cut in the sole D (Fig. 6), as also shown at E (Fig. 2). In Fig. 9, for the outside the piece Fig dispensed with, the buckle being there. Fig. 7 is cut on the double, and so is Fig. 8, but it must be wider at the centre and then cut in half, to admit of lacing together. The form shown in Fig. 12 can have almost any sized back as shown by dotted lines; it has a piece on each side and a toecap, in the centre of which two holes are punched and a lace is put through, the two ends heing just linked in each other at J at a convenient distance from the cap G, and then threaded through H,

cloth produced from the latter being known as "union." The commoner varieties of flocks used for upholstering purposes are here described. Mill-juffs are a "union" flock, grey or mottled, and possessing very little curl; they are principally used for cheap furniture stuffings, etc. Teazed wools are a pure wool flock, but are a bad colour, with no curl, and are manufactured from the fluff and sweepings of the mills; they are very cheap and warm. Black wools are in many different qualities and colours, and are chiefly made by the combing machines used in wool carding; they are of medium curl, are much used for mattress stuffings, and are often blended with coloured flocks and sold as "red spot fancy," mottled mixture, brown mixture, etc., the name denoting what colour has been blended with the black. White wools are a pure wool flock with a full curl and soft elastic feel, which in ordinary circumstances will last for years without matting; an average sample will cost 1s. per 1b. Flock manufacture is usually carried on as an adjunct to a woolen mill, the woollen waste being sorted on large wire grids, which allow the dust and powdered material to fall through. The better qualities are dyed, which beats and opens all the fibres. They are them passed into a curling machine, and blown out by compressed air, and afterwards packed in 50-1b. bags for the market. The short stapled powdered flocks are used to make flock wallpapers, and the dust is sold to farmers for



at the hole near the toe, brought to the centre, linked again, and then put through the second hole in H. Then when the sandal is on the foot these ends of lace are crossed on top of the instep to the reverse side, put through the first hole at I, over the instep again, put through the second hole, and finally tied at K. The forms shown in Figs. 13 and 14 can easily be cut from instructions given above. For sets of patterns, only alternate sizes will be needed; for instance, in children's sizes, 10 to 13, only 10 and 12 would be wanted.

Watch Balance Spring Collet.—To make a watch balance spring collet in brass, the method is to take a length of brass bushing wire with the central hole a little too small to fit on the balance staff. Hold it in a wire chuck in a watch lathe, or put it between centres in the turns, and rough out the collet to the correct diameter, and a little thicker than necessary, without cutting it off the end of the bushing wire. Then drill the hairspring hole, taking care that it is truly at right angles to the wire. Cut the collet off, and broach out its centre hole to go nearly home on the staff. Then slit it with a slitting file, and place it on a turning arbor in the lathe or turns to finish. Use a polished graver, as this will leave a polished cut. Cut the collet down on its under side until it goes so far on the staff that the hairspring hole is level with the hole in the stud in the cock so that the hairspring will lie flat. Then cut the top surface down to the correct height, and put a neat bevel on each edge.

Upholsterers' Flocks.—Flocks are the waste products of the various machines in spinning and preparing woollen and cotton threads for the loom, and in finishing the cloth for the market. The best flocks are cut or cropped from the face of heavy woollen cloths, and these are nearly all purchased for working up again into cloth with a mixture of long stapled wool or cotton, the

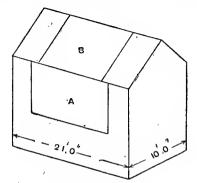
manure. Two machines are required, a "willow" and a curling machine, and an average size machine will require one horse-power. If the willow is for redressing old flocks, allow 25 per cent more power, as some flocks are very badly matted. A high speed will he found necessary.

Re-blacking Sliding Tubes of Telescope.—To re-blacken the sliding tubes of a telescope from which the black has worn off, mix a little vegetable black and some gold lacquer in a saucer to the consistency of paste, and thin the same by adding methylated spirit. Separate the tubes, and with a pencil brush carefully paint the chipped places. This operation is better performed with the tube slightly heated over a Bunsen hurner, but as the outsides of the tubes do not need repolishing, it is better to apply the dead-black cold. When applied cold, the spirit takes somewhat longer to evaporate, and it is necessary to wait and see whether the black has taken properly. If not, a second or third application may be needed.

Photograph Buttons.—In making celluloid buttons containing photographs, ordinary prints are first prepared. These prints (eithersilver albumen, P.O.P., or bromide) are made in the usual way, and after fixing, washing, and drying, may be mounted face down with starch or gelatine on to sheets of celluloid sold for the purpose. If necessary, the photographs may be mounted before they are dried. When dry the photographs are stamped out with a circular or other shaped cutter like an ordinary punch. The print is then placed in a machine with a metal disc and stamped into a button. After this the bent pin, strut, or frame is attached. The process and the machine are extremely simple and can be worked by anyone. As two blows only suffice to complete the button, an enormous quantity can be turned out in a day with one machine.

Oxide of Iron Paint for Ironwork.—Before applying oxide of iron paint on ironwork, it is necessary that the work first receive one or two coats of red-lead mixed with boiled linseed oil. This forms a harder and more elastic priming than any other protective paint, and adheres firmly and allows for the contraction and expansion of the metal. Red-lead requires no driers, and when mixed with linseed oil the two react chemically and form linoleate of lead. Red-lead has been found (by the experience gained in painting large structures such as the Forth Bridge) to be superior to any other pigment for the protection of metal work. Oxide of Iron paint is a good paint for the same purpose, but is in no way equal to red- or orange-lead. The oxide may be used for toning down the aggressive colour of red-lead, or may be employed as a finishing coat, and for this purpose the oxide should be mixed with a little patent driers, thinned down with 3 parts of boiled oil and 1 part of oek varnish. Turpentine should only be added in very small quantities when the paint drags. Red oxide of iron should be tested for fineness by rubbing with oil on a piece of glass, and for depth of colour or purity by mixing various samples with given weights of white-lead. These test samples should be mixed in oil and placed side by side: the sample possessing the deepest colour will be the strongest stainer and the purest.

Photographic Studio.—In constructing a portable studio 21ft, by 10 ft., for portraiture, the side light A should be about 14ft. long, leaving about 3½ft.



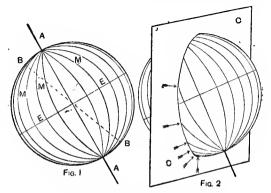
Photographic Studio.

unglazed at each end. The top light B need not be more than 12ft. long. The accompanying illustration shows a good form of studio.

Decdorising Badger Skin Rugs.—To decdorise a large rug made of badger skins, remove the lining, lay the rug on the floor with the hair side down, and cover the skin side with a layer of dry powdered charcoal; charcoal has long teen known as a decdoriser. Allow the rug to remain for a few days in an open airy place, then brush out the charcoal, and ascertain whether it has effected the desired purpose. To prevent recurrence of the objectionable smell, sprinkle the flesh side of the skin with a little carbolic acid. Care must be exercised in using the carbolic acid, as it is not only poisonous, but will raise blisters on the skin.

Arranging Sundials out of Meridian.—The following is a practical method of drawing the hour-lines on a sundial. Take a sphere 3in. or 4in. in diameter (a child's ruhber ball will do excellently) and draw lines on it as if it were meant to be a model terrestrial globe; that is, mark two poles at opposite ends of a diameter, and draw the equator E (Fig. 1), dividing it into twenty-four equal parts; then draw a meridian M through each division of the equator. Push a straight wire as A through the ball, entering at one pole and coming out at the other, and projecting both ways. Fasten one and of the wire in any temporary support in such a way that the wire points due North, that is, to the pole star; then turn the ball on its axis till one pair of meridians is in a vertical plaue. The ball must remain rigidly in this position. It may be here stated that if the model globe be placed in sunlight in the position described above it will serve as a aundial for any place, the time of day being read on the equator where the line at B separating light from shadow crosses it. The intersection of the highest and lowest meridians with the equator, in this case, will give 6 o'clock, morning and evening, and the following intersections give

7, 8, etc. To proceed with the ordinary plane dial, take a sheet of thin cardboard and cut out of it a circular disc of the same diameter as the ball. The ball must fit into the hole so stiffly that the card may be turned into any position without falling off. Place the card on the ball (the ball being halfway through the hole as in Fig. 2), and make the card C stand exactly as the wall does to which the dial is to be attached. Slide the ball in the hole if accessary till a pair of meridians is vertical, and finally see that the wire still points true North. Now, as shown, mark ou the card the points where the meridians on the ball pass through, remove the card, and in the hole replaces the piece cut out. Draw lines from the marks round the hole to the centre of the cut-out circle, and these will be the hour-lines or the dial. The hour-line corresponding to the lowest meridian will be that for 12 noon, if the face of the dial is to be vertical. Of course, only about half of the lines will be of use on any dial. The edge of the gnomon must lie in the same direction as did the wire axis of the model globe. If the gnomon be of appreciable thickness the card templet used for drawing the hour-lines must be divided into two along the noon line and the halves separated by the thickness of the gnomon before transferring the lines from the templet to the actual dial. This method of drawing the hour-lines of a sundial is applicable to all positions of the dial except when its face is parallel to the axis of the sphere, as, for example, when the dial is to face due East or West.



Arranging Sundials out of Meridian.

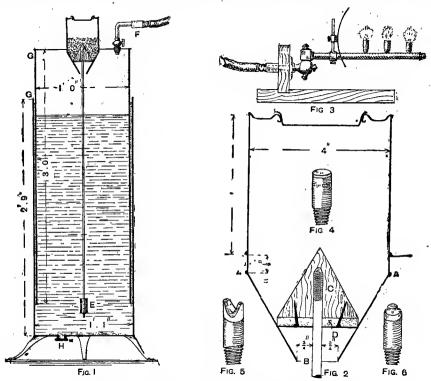
For this case the diameter of the circular hole in the cardboard should be a little smaller than that of the ball. When the card is applied to the ball the meridians which are cut will be intersected in two points each. The card being marked and laid down with the disc which was cut ont re-inserted, the two marks corresponding to each meridian should be joined by straight lines drawn on the disc. These are the hour-lines. The shadow-giving edge of the gnomou must, as hefore, he in the position which the axis of the sphere had with respect to the card when it was held against the ball. If the size of the dial be not suitable all the dimensions can be altered to any given scale.

Slating Roof with Westmorland Slates.—Westmorland slates are thicker and coarser than Welsh slates, but are hard, tongh, and very durable. These slates come from Ambleside, Langdale, and Thang Crag at Windermere, are distinguished by their dull green colour and rough surface, and may be obtained in various sizes, like Welsh slates. The slates are laid upon battens or boarding with the usual lap and gauge and in the usual manner, but when of large size and considerable thickness may be economically laid in the manner described below. "The rafters are placed at a clear distance apart, about 1½ in. less than the width of the slates. Down the centre of each rafter is nailed a fillet, thus forming a rebate on each side, in which the edges of the slates rest, being secured by black putty, or (as this looks smeary and uneven) by a second fillet 2 in. wider than the first fillet and nailed over it so as to cover the edges of the slates and hold them down. Each slate lape about 3 in, over the slate below; only half the number of slates is required in this method as compared with the ordinary method of slating, and no boarding or battens are necessary." If the slates vary in length, the longest should be used at the eaves. If the slates are found to vary in width, the same width must be used in vertical lines up the slope of the roof, but horizontally the slates may be used alternately long and short.

Paste for Papering Lime-washed Walls.—The following recipe makes a strong paste that may be used for a variety of purposes where strength is required, and is excellent for use on lime-washed walls and damp walls. Scak \(\frac{1}{2} \) lb. of glue for several hours in cold water, then dissolve in 1 pt. of bolling water, and whilst hot add, stirring briskly, \(\frac{1}{2} \) lb. of Fonice turpentine. In another vessel make \(\frac{2}{2} \) lb. of four into a paste with 1 qt. of cold water; beat up the paste until it is free from lumps, mix the glue and the flour paste together, and thin down with 1 gal. of bolling water, stirring briskly during all the mixing operations.

Home-made Acetylene Generator and Lighting Apparatus.— The illustrations show an acetylene generating and lighting apparatus. The main part is of zinc, the dimensions being indicated in Fig. 1. The carbide holder is an improvised tin canister with the bettom removed and a truncated conical portion soldered on in its place (see Fig. 2). The soldering line A (Fig. 2) is kept lower than the line of connection with the top of

work smoothly, is that its top-heaviness will render it liable to be knocked over. This must be provided against by attaching suitable feet with provision for screwing to the floor. When the gas begins to be generated the tap should be turned full on, and the burner tried from time to time with a light. The holes in the burners are very small, and it will take some time for all the air to be cleared out of the tubes. When eventually the gas begins to light, the flame will be yellow and noisy, gradually settling down into a beautifully clear and steady white flame. The burners, placed three or four in series with a suitable reflector (see Fig. 3), give an excellent light for general lantern work and for all ordinary illumination purposes, but are liable to bring considerable disappointment in critical optical work. The apparatus under discussion was specially intended for photomicrograph work, but its actinic effect was infinitely poorer (in comparison with its apparent brilliancy) than that of a good paraffin lamp. It has been stated that for cinematograph projections the light could be made to give a 10-ft. picture, but the



Home-made Acetylene Generator and Lighting Apparatus,

the gasholder, to avoid undoing one joint while making the other. The outlet at 'the bottom of the main cylinder is a brass screw cap, to be purchased at any ironmonger's. The fighin rod B is of iron and fits into a wooden cone of in the carbide holder, the under side of wooden cone being lined with a rubber disc D, fin, thick, which serves to make a fairly gas-tight joint at the sides. At the bottom end of the rod a lead weight E (Fig. 1) is attached, which answers the double purpose of creating pressure in the gas cylinder and of making a good joint between the rubber and the sides of the carbide holder. The fittings at F are ordinary house-supply gasfittings, and H is an outlet. In charging the carbide holder a short length of wood is inserted at 6 between the top of the water cylinder and the rim of the gasholder, before undoing the lid. Unless this is done the dome would immediately begin to sink, thus expelling any nunsed gas, as soon as the lid was taken off. The apparatus has worked very satisfactorily indeed, the only difficulty being leakage. At the junction of the lid in the carbide holder it has been found necessary to apply vaseline with the object of preventing leakage, and a large screw-topped chamber is suggested in place of the one shown. Though very simple in construction, the apparatus is perfectly safe. The only danger to be apprehended, if all the parts are made to

writer has not yet seen a picture 5 ft. in diameter that was any good, not even with four good burners and an excellent machine. The 00000 Bray burner (Fig. 4) gives a very steady, clear light, but the two other forms shown in Figs. 5 and 6 persisted in "flaring up" or else in giving a small and altogether worthless flame. These three are specially mentioned as being amongst those most frequently advocated by retailers. If possible, the apparatus should be kept out of doors. Care should be taken, when the water is poured away or agitated in any way, not to bring a flame near to the vessel.

Protecting Hammer Handles.—Handles of beavy hammers, such as sledge-hammers and scaffolders' hammers, are liable to injury if the head misses the point aimed at, the force of the blow being received on the handle. One way of protecting the handle from injury by such accidents is to bind it tightly round with No. 18 gauge copper wire. Fasten down the end of the wire with a small staple, and solder over. Only about 5 in. just below the head need be bound. Another way is to sheath the bandle in No. 16 gauge sheet copper. Allow about \$\frac{1}{2}\$-in. lap, solder, and then put in two or three screws countersunk down. Use resin as a flux, and remember that when soldering copper, especially when the flux is resin, the work should be done quickly.

Thicknesses of Circular Saws.—The following gauges will be suitable for circular saws that have to do general work in both hard and soft woods:—18 in., No. 15; 24 in., No. 14; 30 in., No. 13 T; 30 in., No. 12; 24 in., No. 14; 30 in., No. 13 T; 30 in., No. 12; 24 in., No. 17. Larger saws should increase correspondingly in thickness. With care, all ordinary sawing can be satisfactorily done with sawe of the thickness given. Where T stands against the No. it denotes tight to the gauge. Saws to cut soft wood only should be easy to the above gauges. In fact, a careful practical operator can work them a gauge less in thickness. For cutting exceptionally hard dry wood, saws should be tight to, or even one gauge stouter than, the gauges above. A suitable lead in the teeth for ordinary hard and soft wood sawing will be to an angle of 65° to 70°, or 20° to 25° from the diametrical line; for outting soft wood only, 30° to 35° to the diametrical line, or an angle of 80° to 85°.

Box Solitaire Board.—Solitaire is one of the very few games that a person can play alone. A convenient form of board on which to play the game is illustrated herewith, Fig. 1 being a part section of the box closed, and Fig. 2 a part elevation of the box open for play, the cover being off and placed underneath, where it is held in place by the step turned on the bottom of the box. Any hard white wood is suitable for making the board and cover, and should be turned to the sizes given. Then thirty-seven holes are marked out inside the bottom as shown at Fig. 3, and bored 1/2 in. smaller than the

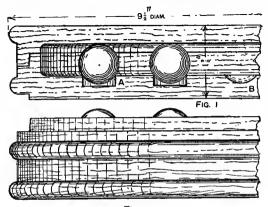


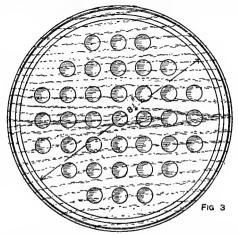
Fig. 2
Box Solitaire Board.

marbles or glass "alleys" to be used, as shown at A (Fig. 1). This holds them firmly in place and yet allows them to be easily lifted for play. The holes may be scooped out with a gouge to fit marbles if preferred, as shown at B. The top should be made just to clear the marbles when it is on, and it will then hold all of them in their places. The game is played by taking out the centre marble and jumping one of the marbles over another into the blank space, the marble jumped over being taken up as in draughts. This is continued until all the marbles are taken away except the last one, and it is necessary to the game are played, and some amount of skill is required to negotiate even the game described.

Repairing Holes in Galvanised iron and Brass Vessels.—To repair holes in a vessel made of galvanised from, thoroughly clean the metal at the part to be soldered by scraping with a suitable sharp-edged tool, and then scour it bright with emery cloth. Next apply raw spirit to the cleaned part, and coat it with solder by means of a copper bit, then flow the solder over the hole to render the bath sound. Holes in brass vessels are repaired similarly to the method described above, killed spirit instead of raw spirit being used for the soldering operation after the metal has been cleaned.

Salmon Fishing Rod.—For making a fishing rod for salmon, procure a piece of greenheart 3 ft. 9 in. long by \$\frac{1}{2}\$ in. square for the buttand a piece of walnut 1ft. 6 in. long by \$\frac{1}{2}\$ in. square for the handle. For the middle part use a piece of greenheart 4 ft. 8 in. long by \$\frac{1}{2}\$ in. square, and for the top joint use a piece of greenheart 3 ft. 3 in. long by \$\frac{1}{2}\$ in. square, and a piece of lancewood 2 ft. long by \$\frac{1}{2}\$ in. square, and a piece of lancewood 2 ft. long by \$\frac{1}{2}\$ in. square, and a piece with counters will also be required. Take the

part to form the butt and place the \$\frac{1}{2}\text{in. ferrule}\$ at one and and give it a tap with a mallet to strike a circle, then at the other end with a pair of compasses strike a circle \$\frac{1}{2}\text{in. in diameter. Plane up the wood square and straight between the two circles, then plane off the corners to form an octagon, and finally round off the edges with the smoothing plane, and rub off the plane marks with a file. Remove the file marks with a steel scraper or a piece of glass and finish with glasspapers of different degrees of fineness. With a \(\frac{1}{2}\text{in. bit bore a 5-in.}\) hole into one end of the handle and taper the hole out with a wood veiner. Plane the end of the butt of fit the hole perfectly and glue it in. When the glue is dry, round up the handle with the plane and work the bottle neck with a spokeshave, finishing with a file and scraper as in rounding the butt. Now take the second part and strike circles with the \(\frac{2}{2}\text{in. bit bore a 1}\) for the butt. Next round up the pieces of greenheart and lancewood to form the top roughly, and taper the top end of the greenheart and bottom end of the lancewood to fit each other, forming a splice \(\frac{4}{2}\text{in. long. Glue the pieces together at the splice and allow to dry, then bind up the joint with a piece of string. When the glue is thoroughly sst, remove the string and round up to an even taper from \(\frac{2}{2}\text{in. at the counters, easing down the wood carefully with a file until the ferrules and counters will drive on tightly with the mallet, fixing each one in position with a small rivet or by a blow on each side with the point of a centre-punch. The rod can then be



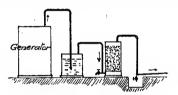
cleaned up with five glasspaper and French polished. Now whip on a set of rings, using about four on the top, three on the middle, and two on the lower parts, placing them at proportionate distances apart. Whip on short lengths of binding below the ferrules and above the counters, also between the rings, whip on a suitable top ring, then give the bindings a couple of coats of shellac varnish, and when this is dry (the uext day) give the rod a coat of copal varnish. The above lengths will make a rod about 14 ft. long, but the lengths may be modified to suit requirements.

Drains Choked by Grease.—One method of preventing a scullery drain-pipe from being choked by grease is to fix a grease-intercepting trap into which the greasy water may flow; such a trap, however, is found to be an abominable arrangement. The trap must not only be frequently cleaned out and the grease removed by hand, but the very objectionable smell that arises from the trap during the process of cleaning is most offensive, not only to the person who has to do the work, but to everyone who may be in the house or in the neighbourhood. A flush-out grease-trap is the best. To this trap is attached an automatic flushing cistern by which the cake of grease that forms on the surface of the water in the trap is broken up and driven through the drains in a solid or semi-solid state.

Removing Cider Stains from Linen.—If the stains on the linen are purely organic stains from the cider, make a solution of chloride of lime, and in this steep the stained portions of the lineu for from fifteen to thirty minutes, followed by thorough washing in several changes of clean water without scap. If the stains also contain iron, steep in a solution made by mixing 1 part of strong acetic acid with 10 parts of water.

Clockwork to Drive Fan.—Below are particulars of a clockwork motor required to drive a fan 10 iu. in diameter at a speed of ahout 400 revolutions a minute. A barrel drum 4 in. in diameter grooved for a line and weight, and fitted with a main wheel of seventy-two teeth, drives a pinion of twelveleaves mounted on an arbor with a wheel of seventy-two teeth. This drives another pinion of twelve leaves mounted on the same arbor as a hand wheel 10 in. in diameter driving the first 2-in. pulley. The 9-in. band wheel mounted with it then drives the 2-in. pulley on the fan shaft. The train is thus:—lst, barrel for line, main wheel 72; 2nd, wheel 72, pinion 12; 3rd, band wheel 10 in., pinion 12; 4th, wheel 9 in., pulley 2 in.; and 5th, fau pulley 2 in. This will give about 800 revolutions of the fan to 1 of the driving barrel, and for 400 revolutions a minute the barrel must turn once in two minutes, and will thus take 6 in. of line for every minute of run. For a run of one hour, the motor will want 30-ft. drop for a single line, 15-ft. drop for a double line, or 10ft. for a triple line. The weight must be determined by trial, but would probably be 40 lb. on a single line, 84 lb. on a detailed.

Acetylene Generating Plant.—The accompanying illustration shows all the parts—generator, washer, and purifier—of a generating plant. The generator itself is shown on the left, and the gas coming away from the generator is shown passing to the washer. The latter is merely an iron vessel of any form, and about three fourths full of water. The gas, as it comes over from the generator, escapes into the washer near the bottom about 3 in. to 6 in. below the water-line (according to the pressure developed in the generator), and then bubbles up and is cleansed of all impurities that are susceptible to water treatment. With many generators the washing arrangement is part of the apparatus, and not a separate vessel as here shown. The water in the washer must be changed once or twice a week. From the washer, the gas goes to the purifier (which also dries



Acetylene Generating Plant.

the gas). This appliance is used for the purpose of ridding the gas of two impurities that are not susceptible to water treatment. The commonest purifying material is chloride of lime (bleaching powder), which is mixed with a little ordinary unslaked lime. The lime is then put loosely in muslin bags, and laid on trays in a vessel, so that the gas must filter through the lime. A material now largely used for purification is Puratylene, which is composed of the same mixture of lime formed into porous lumps. No hags or trays are needed, but only a tall iron or zinc keg, in which a space is left at the top and bottom, as shown in the illustration. From the purifier, the gas goes to the house; but at the commencement of the house service (assuming that this is the lowest point) is a small cock, which is placed there for the purpose of discharging any condensed water that may collect at this lowest point of the service. The generator presumably includes a gas-holder; if not, the best position for the gas-holder is between the washer and the purifier.

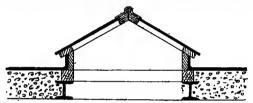
Chrome Red.—Chrome red, a pigment also known commercially as Derby red, mock vermillen, and Persian red, is a basic chromate of lead made in a variety of shades from pale orange to deep scarlet red. The following is the method of manufacture on a large scale. For orange chrome, take 252 lb. of lead acetate or nitrate, 88 lb. of bichromate of potash or soda, and 23 lb. of sodium hydrate or caustic soda (77 per cent.). The bichromate and caustic soda are dissolved separately in large lead lined vats. The lead acetate is also dissolved in a large precipitating tank which has large revolving wood paddies driven by steam power. The greater the volume of water the finer the results. The bichromate solution is then run steadily into the precipitating tank on the lead solution whilst being agitated with the paddles, the result being the formation of yellow chromate of lead (chrome yellow), which rapidly precipitates. The clear water is then run or syphoned off, and the caustic solution run into the yellow. The mixture is now boiled by means of a steam jet and thoroughly agitated until the desired depth of colour is obtained; the mixture is then allowed to cool down and settle, the top water is run off,

and the colour is washed repeatedly with cold water and again allowed to settle, when it is strained upon filter cloths, pressed and dried ready for use. Chrome reds may he modified somewhat by altering the proportions of the bichromate and alkali and the time of holling. The larger the quantity of alkali added the deeper the resulting red, as may be observed by the following table.

| Ingredients. | Orange. | Scarlet. | Deep. |
|--------------------------------|---------|----------|-------|
| Lead acetate or nitrate | 11 | 11 | 20 |
| Bichromate of potash or seda | 4 | 4 | 10 |
| Caustic seda or sedium hydrate | 1 | 11/3 | 3 |

The essential feature in the preparation of chrome reds is the finish or washing of the colour after boiling; all traces of alkaline matter should be carefully removed by washing, otherwise the durability of the pigment will be affected. Chrome reds are good bodied pigments of exceptional covering power and brilliancy, and are durable under ordinary circumstances. But when submitted to sulphurous gases they turn black owing to black sulphide of lead being formed. They should not be compounded with pigments containing sulphur, such as ultramarine, oxides, and cadmium yellow, which have an effectsimilar tothatof sulphurous gases. The purity of chrome reds may easily be determined, as pure reds are completely soluble by boiling in strong hydrochloric acid, any residue heing the adulterant.

Concrete Roof with Skylight.—The accompanying illustration shows construction of a concrete roof containing a skylight. The main difficulty is to keep the roof 'drep-dry,'' and the only really efficient method is to cover the concrete with a 3-in. layer of asphalt (the best



Constructing Concrete Roof with Skylight.

that cau be purchased) turned up all round the frame of the skylight. Detailed description need not here be given of the remainder of the materials and method of construction, as the drawing herewith is selfexplanatory.

Copal Varnish.—Cepal varnish derives its name from the gum copal, a hard lustrous gum found principally on the West Coast of Africa, in the Sierra Leone district. Gum copal is a fossil gum, and is found at varying depths in the soil, from which the gum is dug out by the natives; traders buy the gum and export it to various countries for the preparation of varnish. The best hard copal varnishes (the hardest, most lustrous, and most durable varnishes) are prepared from West Africa copal gum; by carcful selection of the gum very pals varnishes that are suitable for all classes of decoration, both interior and exterior, coach painting, sign and carriage decoration and painting, can be produced. Copal varnishes are prepared by fusing the gum and afterwards adding clarified linseed oil and turpentine; driers, such as litharge, acetate of lead, and manganese, are also added. Varnish is tested for paleness by placing, in a thin glass vial, a small quantity of varnish and comparing it with any standard sample by holding both samples up to the light. In order to test the varnish for wear and durability; apply two coats of varnish to two pieces of newly planed wood, which should be perfectly dry and be carefully glasspapered; one piece of wood should be coated with the standard sample, and the other piece with the varnish that is to be tested. Place both pieces of wood in an exposed exterior situation, and note from time to time the appearance of the work; that piece which loses its brilliance and cracks in the shortest time has been coated with the inferior varnish. Another simple test is to re-varnish any suitable surface with the suspected sample, and when the varnish is thoroughly dry, rub it briskly with the finger; if the new varnish crumbles up quickly, it evidently contains an inferior gum or most probably a large proportion of resin. A good copal varnish cannot be removed in this way unless, of course, exceptionally hard friction is employed.

Chemical Fire Extinguisher.— When the sulphuric acid from the bottle in a fire extinguisher is brought into contact, by breakage, with the surrounding alkaline water, the acid immediately acts upon the carbonate of soda, liberating carbonic acid, and forming sulphate of soda. With carbonate of soda, the following reaction Occurs.

Na₂ CO₃ Carbonate Ho SO Na₂ SO₄ CO_2 Sulphuric Acid. Water.

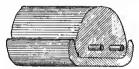
of Soda Acid Sulphate Acid But with bicarbonate of soda, one equivalent of sulphuric acid produces double the quantity of carbonic acid; thus: acid: thus: 2NaHCO3

H₂SO₄ Sulphuric Acid Na₂ SO₄ Sodium Sulphate 2 CO₀ Sadium Carbonic Water. Bicarbonate Acid

Martonate Acid Sulplate Acid Carbonic acid is a gas at ordinary temperature, and is only held in solution in the water in the cylinder by great pressure; as soon as the valve is open, carbonic acid escapes, and forces the water out in a continuous stream till the cylinder is empty, and the pressure is relieved. The water contains both sulphate of soda and relieved. The water contains both sulphate of soda and carbonic acid, and is very much better than ordinary water for putting out a fire, carbonic acid especially being a non-supporter of combustion. No other acids are used, simply because sulphuric acid is the cheapest acid, and weight for weight is more powerful than any other commercial acid. Hydrochoric acid could be used, but would not be found so economical as sulphuric

acid.

Putting Rubber Tyres on Carriage Wheels.—In putting rubber tyres on carriage wheels, the rubber at the joint is not spliced, but it is simply butted together. Measure round the wheel to determine the length of rubber required, but cut off a few inches longer so as to be on the safe side; it can easily be cut off to the right length when the wheel is finished. For putting on rubber tyres a wired-on tyre is best; it requires neither cement nor a machine for fixing on the wheel. The illustration shows a section of a wired-on tyre. To put the tyre on, take two wires and screw the ends to suit the nuts; place the two ends level and



Section of Wired-on Tyre for Carriage Wheel.

fasten up in the vice; then, with a tape or wax-line, measure round the wheel; allow \(\frac{1}{8} \) in more than the circumference, and mark off the two wires to the length obtained (not cut off). Now cut off the rubber, and, as it has to be cut off so much longer to allow for compression, the rule is as follows. After getting the circumference of the wheel, allow \(\frac{1}{1} \) in. for every foot in length. Thread the wires through the rubber, and when the screwed ends are projecting about \(3 \) in., fasten a small clamp on each wire to prevent them slipping back. Now take the wires at the other end of the rubber, fasten them in the vice, and pull the rubber well back until the end is beyond the marks that were made at the commencement. Fix two small cramps to keep the rubber in position, cut off at the marks, and screw the ends to fit the nuts. Now circle the tyre, place the screwed ends of the wire together, and fasten them by the nuts; when screwed up tight, take off the clamps and let the rubber come together; put the rubber on the wheel as far as possible, and hold in position by clips. To get into the channel the remainder of the tyre, work it over with a lever, gradually working all round and hammering down with a rubber mallet until the rubber is in position. the rubber is in position.

Finishing Cases of American Pianes.—High-grade American pianos are mostly of massive build, and are finished in a manner very different from that usual on English goods. The latter are of French-polish finish, whilst the Americans build up the surface with varnish; and in this matter it is interesting to note that the varnisher has high-grade goods on his hands for nearly three months, varnishing and drying, re-varnishing and re-drying, till a surface is built up that will stand scouring with pumice powder, each application of varnish being allowed to stand several days before the next is applied. The operations of varnishing, drying, and smoothing down are carried on in order until a perfect gloss is gained and the grain of the wood reflects all its beauty. It is also interesting to note that even on some expensive instruments choice veneers are seldom used, the finishers being thoroughly expert at closely imitating Nature's handiwork. The figure is gained for the most part by mechanical means, Finishing Cases of American Pianos.-

ench as soft leather graining rollers, thus ensuring greater uniformity of figure and colour. Each part of a piano is thus yaruished at least six times and placed in a warm drying-room, the surface each time heing smoothed and dulled down, till the last or "flowing" coat is applied, for which purpose the finest badger-hair brushes are used. This gives a level, bright finish somewhat similar to that seen on best carriage work. Toning down is effected by rubbing with finest possible grade pumice powder and rottenstone, finishing off with the workman's bare hand, which imparts a better finish than cloth. Finally the lustre is brought to a high degree of perfection by rubbing with piano oil cleared out with alcohol. The composition of the varnish differs very much from that used by French polishers, being very elastic, yet tough enough to withstand the grinding-down process; consequently, the varnish cannot be satisfactorily made on a small scale. Another characteristic of American instruments is the frequency with which one meets dull panels, which considerably enhance the beauty of the bright portions. Unfortunately, in large towns with sulphur-laden atmospheres, these varnish-finish goods soon bloom or acquire a smoky appearance unless often rubbed up; and as constant rubbing by dry dusters eventually produces a scratched appearance, the better plan is to freehen up occasionally with piano oil. For this, mix sweet oil and turpentine in equal parts; but before using it, every particle of dust or dirt should be removed. A lump of common washing soda the size of a walnut should be dissoived in 2qt. of rainwater, and the case washed down with this, using a soft chamois leather. Rub on a little of the piano oil, using wadding, and wipe off with soft rag, and then wipe with another piece of soft rag or old silk handkerchief with a few drops of alcohol sprinkled on its face, and well pressed in. Vapour up to a fine polish by applying very lightly at first, and working always in a straight direction.

Removing Fired Box of Axle Arm.—To remove from an axle arm a box that has fired, take the other wheel off the axle and then remove the axle from the carriage. It is necessary to uncorew the front cap of the box that has fired, and to stand the axle on its end and fill up the front end of the box with oil. Then screw on the cap to prevent the oil running out, hold the box over a fire and



Wrench for Removing Fired Box of Axle Arm.

heat it until it can be barely touched without burning the hand. Fix the axle end upwards in a strong vice, fasten a wrench as in the illustration on the box and try to turn it round on the axle arm. If it will not move, mix some paraffin with the other oil and repeat the process. When the box moves on the arm, fix the axle horizontal in the vice, and whilst turning the box round get an assistant to give some blows on the back of the box, using for this purpose a piece of hard wood and a small sledge hammer, and so drive the box off the arm. If it will not come off with this treatment, then the only remedy is to smash the box, and, if the arm is not cut too badly, have a fresh box fitted on. The wrench mentioned should be fixed on the box so that the webs are close to the bolte.

Door Knocker Electric Bell Push.—A novelty in electric bell push design is one in which the knocker and bell work simultaneously. The device can be easily made by connecting the bolts at top and bottom, which come through the door from the knocker and pad, separately to the bell wires. If the handle happens to be connected with the pad through a metallic base, the latter will have to be drilled through and a metal pad inserted and insulated from the base by a wooden or vulcanite washer, but connected on the inside with the lower wire. A small spring will be required under the upper portion of the handle to keep it off the pad when not in use. The circuit then will be completed only when the knocker strikes. Door Knocker Electric Bell Push.-A novelty in

when the knocker strikes.

Finishing Boot Waists.—There is no practicable method of finishing the soles of the insteps of boots with a brush and will dry quickly. The quickest method is by a power-driven hurnisher, and the next in speed is hand burnishing. This is after the burnishing ink has been applied and allowed to get all but dry. Hold the toe between the knees with the heel against the chest quite firm, and press hard while rubbing up and down with a two-handled burnisher. Then put on a little fake, made by melting hard heelball and a little white glezing ball in mineral naphtha, in a slow heat sway from any fiame, and when nearly dry polish off with a dry, soft cloth.

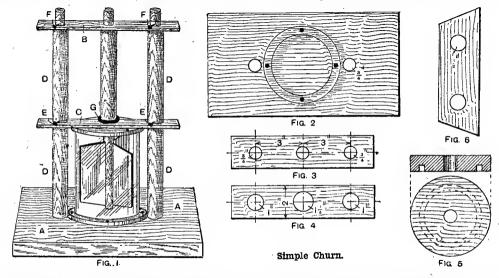
Simple Churn.—The household churn illustrated by Fig. 1 will make \(\frac{1}{2} \) b. of butter at a time, taking for the operation ten minutes. In cold weather the time is slightly longer, but if the cream is warmed, slightly less. It has stood the test of experience in all weathers and climates. The container is an ordinary preserved-plum jar about \(6\)\frac{1}{2} in. by \(3\)\frac{3}{2} in.; of course, any vessel of similar size may be used, and earthenware or tin might be employed, but a glass bottle is much the best, as the process may be watched. The bottom portion of the dasher (below the collar) should be grooved out to fit the dasher blades, \(\frac{1}{2} in. \) deep; the grooves should be a fit with the dasher blades, \(\frac{1}{2} in. \) deep; the grooves should be a fit with the dasher blades, \(\frac{1}{2} in. \) deep; the grooves should be a fit with the casher blades, \(\frac{1}{2} in. \) deep; the grooves should be a fit with the casher blades, \(\frac{1}{2} in. \) deep in the outsiner cover on from the bottom (the hole in the covertainer cover of from the bottom (the hole in the covertainer cover of norm the bottom (the hole in the covertainer cover of into water for an hour, when the blades will be found quite tight. The base \(\text{ is lift, long, \(\frac{1}{2} \) in the ond and \(\frac{1}{2} in. \) internal diameter (see Fig. 2). The top fastener B (Fig. 1) and cover fastener C (see Figs. 3 and 4) are \(\frac{1}{2} in. \) thick. The standards D (Fig. 1) are \(\frac{1}{2} in. \) in diameter and \(\frac{1}{2} in. \) in the centre of each for pins \(\frac{1}{2} in. \) in diameter and \(\frac{1}{2} in. \) in the centre of each for pins \(\frac{1}{2} in. \) in the cover. It is \(\frac{1}{2} in. \) the cover is \(\frac{1}{2} in. \) in outer diameter, with \(\frac{1}{2} in. \) the cover \(\frac{1}{2} in. \) in outer diameter, with \(\frac{1}{2} in. \) groove, \(\frac{1}{2} in. \)

to the distances likely to be used; the latter, however, is not usual. The second line shows the proportions at these distances. The lines below show the exposure at any other greater distance when the exposure is one second at any point. Multiples of these may, of course, be used if desired.

Actual d1s-12345678910 11 12

tance.
Proportionate 1 4 9 16 121 144 25 26 49 64 81 100 36 16 9 6 118 313 218 218 2 118 1 218 Proportionate exposuresfrom one second at either tance.

Vermilionette and Vermilion.—Vermilionette (also known as mock vermilion, signal red, and royal red) is prepared from aniline dyes, cecine heing the principal agent. The shades of colour in general use vary from a pale pink to a deep scarlet. These colours are struck or tinted on harytes and orange lead in variable proportions, the precipitating agent being lead acetate or



from the edge, and a central \(\frac{1}{2}\) in. hole. The dasher has three blades, \(\frac{1}{4}\) in. wide, \(\frac{4}{2}\) in. maximum and \(\frac{3}{2}\) in. minimum length, and \(\frac{1}{2}\) in. holes. Fig. 6 shows the shape of one of the blades. The centre spindle is 1 in. in diameter at the top, with \(\frac{1}{2}\) in. for the blades. The collar \(\frac{6}{2}\) (Fig. 1) is 1 in. thick and \(\frac{1}{2}\) in. for the blades. The collar \(\frac{6}{2}\) (Fig. 1) is 1 in. thick and \(\frac{1}{2}\) in. in diameter. To use the machine, slip the container into the bottom ring (see Fig. 2), fill it three-quarters full with cream, put in the dasher, fix the cover on the bottle, slide the cover fastener on from the top, and fix it hard down on the cover by the two pine, which should fit tight into the holes in the standard just level with the top of the cover. Now slide on the top fastener and fix it similarly with two pins, fasten the churn by a cramp to \(\frac{1}{2}\) table top, take half a dozen turns with string round the dasher stem above the collar, and pull it sharply to and fro. To prevent losing the pins, they should be fastened to the standards by small staples and strings. When not in use, always keep the container full of clean water, with the dasher in position. The woodwork should be made of teak, which will stand the wetting and drying, and does not taint the butter.

Proportionate Exposures for Photographic Prints on Bromide Paper.—The statement that the "intensity of light varies inversely as the square of the distance" indicates the proportionate intensities of light at different distances, and the exposures will be in direct proportion to these intensities, all other factors remaining constant. In the next column of this page appears a reliable table showing the exposure needed at any distance, provided the exposure at some other distance is known. The figures in the top line may be taken either as inches or as feet, according

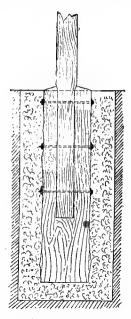
nitrate, the depth of colour depending on the quantity of eosine that has been used. Some makers use aluminium sulphate, instead of lead acctate or nitrate, but the resulting colours are less permanent and less brilliant. Vermilionettes are much used by coach painters for the stringing or lining of vehicles; but these colours are not recommended in cases where permanency is required, as the tints fade after a few months' exposure, especially when subjected to etrong light such as the sun's rays. The durability of these colours may, however, be somewhat lengthened by coating them with a hard drying varnish. Vermillonettes are in no respect comparable as regards permanency with pure vermilion; vermilionettes may be easily distinguished from vermilion by mixing a small quantity of the suspected colour with water, and rubbing the mixture on the finger-nail; should any stain be left on the nail after the colour has been removed, the paint is vermilionette. Heat also destroys vermillonette, and when mixed with water, it exhibits a peculiar fluorescence; this fluorescence is also noticeable in the water that is placed in the package in which the paint is stored as an oil paint in paste form. All these tests for determining the adulteration of vermilion with vermillionettes are simple and accurate. Madder reds, which are less costly than vermilion, are now finding favour among coach painters and decorators, owing to the brilliancy, permanent shades, and density of colour of shades, some of which resemble vermilion in appearance, and possess even greater covering powers. Many of the large railway companies and fire brigades are adopting these colours in preference to vermilion. Other notes on vermilion, its use and its liability to darken, are given in Series II., p. 223.

Ignition for Bicycle Petrol Motors.—Ignition by incandescent tube on a bicycle petrol motor is out of the question. The drawbacks of tube ignition are numerous, two prominent faults being inability to keep the tube at the proper heat, largely due to the excessive vibration; and misfiring, due to the high speed (about 2,000 revolutions a minute) at which these motors have to run to develop their power. Electric ignition systems; one with coil and accumulator or battery, the other being magneto ignition. The magneto system is undoubtedly the better, there being no wires to short-circuit, and no coil or accumulator being needed, therefore there are no troubles about charging accumulators, etc. There may be a few more wearing parts, but three-fourths the troubles usual to the coil ignition cannot be adapted to any existing cycle metor; this is the reason the coil ignition is at present-to-largely employed, as it can be used with any type of motor, whereas magneto machine and motor have to be built together by the manufacturer.

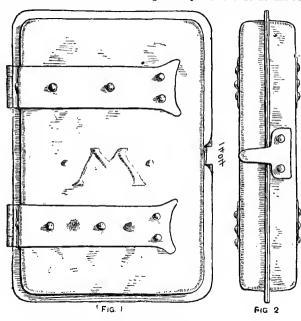
Fixing High Flagstaff.—A method of fixing a high flagstaff is explained below. The depth and diameter of the hole will vary with the nature of the soil. Get the trunk of a young elm tree about 1 ft. 6in. in diameter, and a few inches longer than the hole is deep when the bottom layer of concrete has been put in, and make two saw.cuts down the middle, about 4 ft. long, and say 2 in. less apart than the diameter of the flagstaff. The middle

If the tool is not stationary but revolving in the lathe, it should be revolved as slowly as possible, and the polishing done by means of tripoli. If the prism is very badly scratched and defaced, it should be ground up with fine emery on a special tool. But this should not be attempted by an unskilful operator, unless the prism is of little value, because it is almost sure to have its shape altered, and be spoilt.

Cigarette Case.—The cigarette case shown by Figs. 1 and 2 is intended to be worked in copper, about No. 21 or No. 22 B.W.G. The edges of the two halves are hammered up first, the projecting rims being put on afterwards. A good effect is obtained on the surface of the copper by hammering it well with the ball pene of a small hammer before raising the edges. The metal must be constantly annealed during the latter process, and if the hammering is done slowly and carefully no great difficulty will be found. Each rim must be cut out in one piece, trimmed to fit flush with the inside of the hammeredge, and then neatly soldered or brazed on. The hinges can be obtained from the pieces cut out in making these rims. They should be made as fine as possible with straps as shown in Fig. 1, and a piece of steel piano wire makes good pins for them. The straps of the hinges are held by brass wire rivets worked up to a head on the outside (see Fig. 2) and countersunk inside. Where the hinges go, the projecting rim is cut away. The catch fastening the case can be made so that the tongue snaps over a small stop, or the tongue may simply hold the two halves together by friction. It should be



Fixing High Flagataff.



Cigarette Cass.

plece will then have to be cut out, and the best way to do this is by means of a red-hot wire. Then are or saw the bottom end of the flagstaff down to fit tight in the trunk, and secure it in place by three bolts as shown in the accompanying illustration, placing washers under the heads and the nuts. The bettom end of the trunk should be cut level, so as to sit flat on the concrete, and the top end should be bevelled towards the outside to let the rain run off.

Repolishing Prisms.—A Nichol prism is finally polished on drypaper, which is less liable to round the edges than cloth or silk. Stick cartridge paper on a flat surface plate, or on a flat chuck which may be revolved on a lathe. Mix together a teaspoonful of starch and a little cold water to a consistency rather thicker than that of cream; on this pour boiling water, and stir quickly; then rub a little over the centre of either surface, lay the paper on, and press down with another flat surface. When dry, rub a little rouge on with a piece of tissue paper, rubbing as much off as possible. Then proceed to polish. Give five or six rubs from left to right in a circular direction, and then five or six from right to left. It is most important to keep changing the direction of the sweep.

riveted on in either case. To keep the cigarettes in place, small steeleyes made from wire are soldered inside each half and a piece of round cotten-covered elastic is stretched across with a knot at each end. The case can be lined with thin black leather or may he left quite plain, as preferred. For cleaning the metal after the case is finished, an old tooth brush and some scouring soap will be found effective, as by this means every cerner can be reached. The initial of the owner's name can be embossed on one side of the case, and should be done on a pitch block in the ordinary way before the rims are fastened on. Suitable measurements for a case to hold twelve ordinary cigarettes are $2\frac{\pi}{5}$ in. by $\frac{\pi}{12}$ in. by $\frac{\pi}{12}$ in. inside.

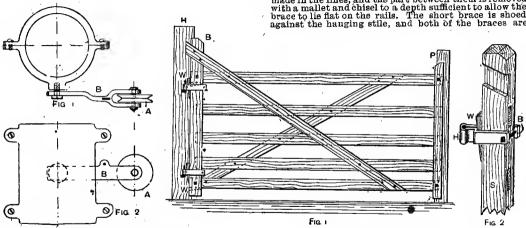
"Slap Bangs."—By "slap bangs" is meant the small packets which explode when thrown violently ou the pavement. These may be made by mixing carefully with the hands I part of powdered sulphur or flowers of sulphur with 4 parts of chlorate of potash. About half a teaspoonful of this mixture is placed in each tissue paper andscrewed up. A finer "bang" is produced with a few grains of fulminate of silver, but this is much more expensive.

Putting on the Chain of a Lever Watch.-Here are Putting on the Chain of a Lever Watch.—Here are hints as to the manner in which the chain is put on an English lever watch. Put in all the train wheels, etc., including the third wheel. Turn the fusee round until the fastening for the chain hook is against the edge of the movement. Turn the barrel round until the hook hole is outside. Hold the movement in a vertical position with the fusee uppermost, and drop the chain (the barrel hook being first) through the place the chain must occupy; then hook the barrel hook in the barrel, and placing a key upon the bearel arbor scarre wind must occupy; then hook the barrel hook in the barrel, and, placing a key upon the barrel arbor square, wind the chain upon the barrel, guiding the chain with the fluger tip of the hand that holds the movement, and hook the fusee end into the fusee. Place the barrel ratchet on, and "set up" the mainspring about half a turn; the chain will then be tight, and all wound upon the barrel except about a quarter turn on the fusee. Now place a key on the fusee square and wind the watch up; this transfers the chain from the barrel to the fusee. See, while winding, that the chain does not drag sideways, or it will be pulled out of the fusee grooves.

Converting Cycle Petrol Motor Into Free Engine. Converting Cycle Petrol Motor into Free Engine.—Below are hints, accompanied by diagrams, on fitting the driving wheel of a motor hieyele to the shaft of a motor in such a manner that it could be thrown out of gear when desired, which would be of great advantage when coasting. If the motor is not built with a free engine clutch, the only means of converting it into a free engine is to use a jockey attachment (shown in plan and elevation at Figs. 1 and 2), which must operate on the driving belt between the engine pulley and these bellows being primarily to transmit power rather than to emit a tone or note. Some instruments are furnished with reeds as an accompaniment to the notes given by the piano. These reeds should always be in unison, the piano being tuned to the attachment, and they can be played at the discretion of the operator, the connection being made by simply drawing out a stop knob, which thus connects an extra set of pallets, these working simultaneously with those which operate the piano keys. The striking movement can be gained either by a lever affixed to each small bellows, or by plungers (round rods) similar to those used in American organs.

by a lever affixed to each small bellows, or by plungers (round rods) similar to those used in Americau organe.

Field-gate Construction.—The ordinary field gate, as a rule, is put together in the rough. The rails (shivers) are not tenoned, and the mortises are so marked off and made in the hanging and swinging stiles that the rails, when inserted, show them to be spaced as in Fig. 1. It will be noticed that the gate is so hung to the hanging post H that the swinging stile beats against the beating post P. The top and bottom mortises in the hanging stile go right through, but the other three mortises go only about halfway in the stile, this being the stronger method. All the mortises in the swinging stile go through. The hanging stile is placed flat ou the bench against a stop. The rails are now driven with a heavy hammer snugly into the mortises, the top and bottom rails being wedged as at W and pinned as shown. The swinging stile is next driven on and each rail is wedged, and the top and bottom rails are pinned, the rail ends and wedges being then sawn off fair with the stile. The long brace B (Fig. 1) is now placed in position and lined off on the hanging stile. Two saw-kerfs are made in the lines, and the part between them is removed with a mallet and chisel to a depth sufficient to allow the brace to lie flat on the rails. The short brace is shoed against the hanging stile, and both of the braces are



Converting Cycle Motor into Free Engine.

Field Gate Construction.

driving rim on the wheel. But the use of a jockey pulley is not recommended at all, as it has the following disadvantages. (a) Reduction of horse-power of motor; (b) wear of engine pulley and belt when the helt is slack and the engine is running free. The jockey attachment is operated either by raising or depressing the jockey wheel A by means of a rod attached to B. By this means the belt can be either tightened or slackened. When the belt is slack the engine is free, and when the belt is slack the engine is free, and when the belt is tight the engine is in gear. By far the best method for coasting, etc., is to use an exhaust valve lifter; this releases the compression, cools the cylinder by drawing cold air into it, and prevents waste of petrol through the inlet valve. Exhaust lifters are generally operated by a Bowden wire.

operated by a Bowden wire.

Mechanical Pianoforte Players.—The main features of mechanical piano players are alike, but they vary in details. There are main bellows and small bellows, one for each note. The pianista music folds up like a book; in the pianola and most up-to-date mechanical players the music sheets are on revolving rollers. The mechanical principle of the pianola is pneumatic. As the operator works the foot pedals, the music sheet on one roller is unwound and winds itself over another roller. In its passage the music sheet travels over a cavity box with small apertures, one to each note, the air passes through the perforations in the music sheet which represent notes, and thus the air releases the corresponding pullet. A set of small sensitive bellows operates the pallets thus released, this in turn operating the striking finger situated immediately over the piano key. There is one small bellows for each note, the object of

nailed to the rails with 21-in. rosehead nails, and clinched. nalled to the rails with 24-in. rosenead nalls, and clinched. In some cases small bolts are used to secure the braces. Fig. 2 illustrates a method of securing the hanging H to the stile 8. The hanging is slipped over the stile, and the bolt B passed through holes in the hanging, and secured with a nut, a hardwood wedge heing driven in at W. The usual length of this gate is from 7 ft. 6 in. to 8 ft. The hanging stile is 4 in. or 44 in. by 3 in., the swinging stile 24 in. by 3 in., the swinging stile 25 in. by 3 in., the rails are 4 in. by 14 in., and the heights of the hanging and swinging stiles are 5 ft. and 4 ft. 3 in. respectively. 4 ft. 3 in. respectively.

Aftering Hairspring of Geneva Watch.—Before altering the hairspring of a watch as a remedy for losing or gaining, make sure that the defect is not caused by some other fault. Hands that are too easy, or that touch the dial or the glass, make a watch lose. Or a sticky hairspring, or one that is cramped up and touches something it should not, will make a watch gain. If none of these faults exists, to make the watch go slower the hairspring must be unpinned, let out a little, and re-pinned again. To make the watch go faster, the spring must be taken up a little shorter. After either operation the watch will be out of beat, and must be set in heat by turning the hairspring collet round on the balance, by inserting in the slit in the collet the thin blade of an oiler, and using it as a lever. To effect any of these alterations, the balance cock must be removed. But before removing the balance cock the watch train must be stopped by wedging the third or fourth wheel. Alterations of the hairspring require great care and much skill and practice, and a novice who does not know how to remove a balance cock is advised not to touch a hairspring.

Formalin as Disinfectant,—The disinfectant formalin (formaldehyde, $\mathrm{CH}_2\mathrm{O}$, in aqueous solution) coagulates all albuminous matters, and it therefore destroys bacteria by chemical action; and also, by similar action, coagulates any material on which bacteria would grow. Formalin is also a very volatile substance, and penetrates every corner of a room. The disadvuntages of formalin are that it is very pungent, rapidly attacking the mucous membrane, and hence cannot be breathed with impunity. Formalin is sold in solution in water, at a strength of 40 per cent. A room may be disinfected either by spraying from without or by placing several saucers filled with formslin in various parts of the room. The room should be closed up until the formalin has passed away.

Bamboo Worktable.—The frame of a worktable of li-in bamboo should be dowelled up in the ordinary way as when making a best two-shelf table, except that the four second rails are lowered to within 5 in. of the bottom ones. A wood top is made of i-in. beard, 2ft by 1ft. 4in., and the stand is made in proportion, the legs being 2ft. 3 in. long and the rails 18 in. and 11 in. long. A wood bottom, also of i-in. board, is fitted for the box and secured with 2-in. panel pins. The four panels which form the sides are of Japanese best lacquer, and are secured similarly. A frame of 1-in. bamboo is made for the lid A and mitred at the corners, and a lacquer panel



Bamboo Worktable.

is fitted in and fixed. It is then swung on two strong nails at the two back corners, and a wood stop keeps it from going in too far. Another way to make the lid is to fit the panel without the frame, and hinge it on to the back long rail with brass butt hinges. The wood top is nailed to the legs, and three lacquer panels are fitted, the front being left open for the drawer-way. The drawer is made of \$\frac{1}{2}\$-in. haywood, dovetailed, and a lacquer face is fixed on the front. Bearers are put in for the drawer, and a lacquer panel 2ft. by 1ft. 4in. is fixed on the wood top. The drawer front, box lid, and the seven panels are all beaded with black cane, and a hooping of l-in. split bamboo is worked round the top. The box and inside of the lid may, be lined with Japanese leather paper, velvet, or quilted satin. Fix brass drop handles on the drawer and a small knob on the box lid. Varnish the table with brown hard spirit varnish.

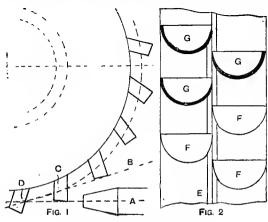
Liquid Grain Filler for French Polishers.—
Primarily, the object of a grain filler is to fill up the pores of the wood, thus giving a solid foundation on which the lac solution or polish is laid. The more solid this foundation the less will the wood absorb the liquid polish. Generally paste or putty fillers best fulfil this purpose; but on cheap work a liquid filler is occasionally used, simply because it requires the least amount of labour in its application. Low-grade resin varnish has also been tried, and is spread over the surface like paint, one or more applications being given; when dry, it is scraped off the surface by a cabinet-maker's steel scraper, under which the surplus resin files off like dust. This leaves the pores or grain filled up with resin only. A tougher liquid filling closely resembling japanner's gold-size is made as follows. Linsced oil, 1 gal; shellac, 12 oz.; litharge, burnt umber, red-lead, 8 oz. of each; and sugar of lead, 6 oz. Boil for four hours, or till everything is dissolved, remove from the stove, and gradually add l gal. of turpentine which has been pre-

viously warmed. The japan is used either alone or mixed with whiting, plaster-of-Paris, cornflour, starch, and colour pigments, and forms the binder of most of the American paste grain fillers.

the American paste grain fillers.

Bodying-up in French Polishing.—Bodying-up is the stage of French-polishing known as building up the surface of lac. This, on best work, is done by means of rubbers only, but ou cheap work the process is hastened by the application of one or more coats of varnish, which should be a spirit varnish of shellac basis. On some goods a foundation is built up of grain filler, polish, or spirit varnish, and finished off exactly as a painter or decorator finishes off grained and best work, that is, by applying copal, hard oak, church oak, or carriage varnish. These varnishes are applied by means of painter's hog-hair brushes, whereas spirit varnishes are best laid on by camel-hair brushes.

Buokets on Pelton Water Wheel.—On a Pelton water wheel the space between the buckets depends on their size and the quantity of water available. Fig. 1 shows method of spacing, the dotted lines A and B being centre line of the jets. The bucket C should be just commencing to take the water when the centre of the jet is striking the centre of bucket D. The second dotted line B shows a portion of the centre of a second jet if two jets are arranged for. Fig. 2 shows the face of an improved method of fixing the buckets. E is the edge of the wheel



Buckets on Pelton Water Wheel.

brought to a sharp point; on the side are fixed the single buckets F and G in alternate positions, the buckets on each side of the continuous dividing edge catching the water alternately, thus securing a steadier motion. With this improvement an efficiency of 80 per cent has been attained. The impulses are divided more regularly on the wheel, as each bucket passes the point of the nozzle and catches its portion of the water. In this type of wheel several jets may be used. The buckets F are shown in elevation, and the buckets G in section.

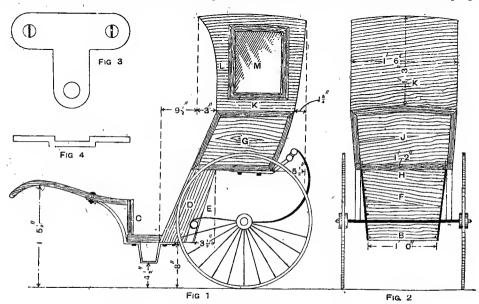
Repolishing Telescope Lenses.—Badly scratched telescope lensee should be replaced, as repolishing is expensive. But if the lenses are small and inexpensive, and not very badly defaced, proceed as follows. Get a hoxwood chuck and some barrel pitch. Heat the latter over a spirit flame, and with it attach the lens to the chuck. The lens should be placed centrally on the chuck. And revolve quite truly in the lathe. It may be necessary to heat the lens gently with the spirit flame before it is successfully mounted. Now get another block of wood and turn it flat on the face, and slightly larger than the lens to be polished. Affix to the block, by heating it to the consistency of dough and working it with the finger. The lens being cool on its chuck, cover it with a fine spray of saliva, and press it circularly into the pitch of the tool. The pitch, being warm, will take the shape of the lens, and the saliva will prevent it sticking. With this tool the lens may be polished, using fine putty powder moistened with water, the lens being slowly and regularly revolved in the lathe, and the polisher being with a slightly quicker motion revolved in an opposite direction. Deep scratches cannot be obliterated by this method, but if there is only a little cloudiness over the surface of the lens, this is soon removed. There is always a risk of an unskilful operator ruining the lens by incorrectly manipulating the tool.

Cleaning Upholstered Furniture.—An excellent cleaner for furniture serges, tapestries, moquettes, and carriage cloths is spirit of wine 2 parts and ammonia 1 part, to be rubbed in rigorously with a swab of soft rags. For saddlebags and woollen velvets, after beating the material, wipe over with water and oxgall in the proportion of one oxgall to a pail of water: this will revive the colours wonderfully. Silk velvets, plushes, satin brocades, and silk tapestries cannot be successfully cleaned without being taken off the furniture. Wiping over with a swab moistened with benzine will revive the materials to some extent, but great care is needed not to overdo it. Surface stains can be removed by gently rubbing with one of the soft putty rubbers sold by stationers, or with fuller's-earth made into a thick pasts and allowed to dry thoroughly on the fabric, and then brushed off. Hair seating can be cleaned with paraffin and then rubbed over with black ink.

Goat Chaise.—If the goat chaise (Figs. 1 and 2) is to be painted, construct it of whitewood, but walnut or birch, with ash mouldings, looks well if finished in the natural wood. For the body, get two pieces of wood lft. long, 2in. wide, by 1 in. deep; plane them square

pins. To carry the roof boards, four hoepsticks \$\frac{1}{2}\$ in, wide by \$\frac{1}{2}\$ in, thick are let in flush with the top of the side, which is bevelled to the shape of the roof, and for the covering \$\frac{1}{2}\$ in, pine should be used. Give it two coats of light lead colour, puttying all nail holes after the first coat; then give it a coat of smudge paint, and when that is tacky, put on some moleskin, and sleek it down from the centre, turning it over the edge of the roof \$\frac{1}{2}\$ in, and then tacking it down to keep it water tight. A bead \$\frac{1}{2}\$ in, wide round the back and sides will hide the tacks. The wheels are \$2 \tau\$t. in diameter, the C springs having one plate. The axle is \$\frac{1}{2}\$ in. square, with a washer and linch pin, and brass caps outside. When the head is finished, three small iron plates (Fig. 3) are fixed inside on the bottom, two near the front of the panel and one in the centre of the back; they slip into sockets (Fig. 4), and are fixed by a screw.

Re-varnishing Tacky Seats.—For removing tacky varnish, mix thoroughly together equal parts of spirit of turpentine and spirit of wine, adding a little carbonate of potash to unite the liquids. Pour a small quantity on a piece of felt or flannel, and rub briskly until the varnish is all removed. Then sponge down



Goat Chaise.

and true on three edges, and get the hevel for the outside from Fig. 2. Then box out the top inner edges ½ in. each, and put in a board B (Fig. 2) crossways of the grain. This board is compassed in 1½ in. at the front (see c, Fig. 1). The rockers D are ½ in. thick, 5½ in. at the bottom, and ½ in. at the top, by 1ft. 1½ in. deep in a square line, and are boxed out on the back edge ½ in. each way to take the heel panel F (Fig. 2). The rockers are fixed at the bottom with No. 101-in. screws, and the top panel G is 1 in. thick by 1ft. 1½ in. long on the bottom, and sorewed on the rocker 1 in. down, the screws being put in from the inside of the rocker. The seat, H (Fig. 2) is ½ in. thick, and is screwed under the side panel, and fitted between the rockers. Being included in the depth of the panels, it must he let in flush at the back ends. The back panel J is 10½ in. deep in the centre by ½ in. thick, and should be boxed into the end of the side panel ½ in. on by ½ in. deep, and fixed with ½-in. brass panel pins. The mouldings round the body are 1 in. wide by ½ in. thick, mitred at the corners, and the front board is 7 in. deep, and in two parts, so as to be bant to the sweep, the grain being perpendicular. The shafts are 1ft. 9 in. long by 1½ in. square, bent in one piece of wood from point to point, and are fixed by screws to the panel, being supported by an iron stay. The head K (Figs. 1 and 2) is portable, so as to have an open or a closed chaise. The side pieces L (Fig. 1) are 1ft. 6 in. long on the top by 1ft. 1½ in. on the bottom, and ½ in. thick, and can be framed together. The glass windows Marel II in. deep by 3½ in. wide, and the moulding around them may be metal bead, with shauks soldered into the back. The corners being mitred together, the back panel should be boxed into the side panels, and fixed with 1½-in. brass panel

well with soap and water. Before re-varnishing the work, allow it ample time to dry. Then apply a coat of glue size, which should also be allowed to dry. The work is then ready for varnishing. If the seats are interior fixtures they should be given two coats of hard church oak varnish, or a varnish made by mixing 1 part gold size with 7 parts of inside oak varnish, but for exterior use a more durable varnish will be required. Carriage or copal varnish will he most suitable, and should be mixed with about 1 part gold-size to 7 parts varnish. This will give to it good drying properties, and prevent stickiness. The above proportion of gold-size should not be exceeded, or otherwise the work will he liable to crack. Another essential feature of successful varnishing is trapply it in a warm atmosphere, free from damp. Dampness in the air causes blooming and other evils.

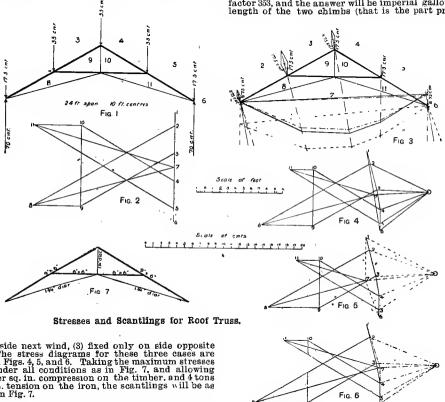
Sulphate of Iron.—Sulphate of iron usually is made from iron pyrites occurring largely in shales from the coal measures, and the shales are piled in large heaps and watered from time to time; the iron pyrites is thus oxidised with the formation of sulphate of iron and free sulphuric acid. The water running from these heaps is collected in tanks, and scrap iron is added, to it to neutralise the free sulphuric acid: it is then evaporated until, on coeling, the sulphate of iron crystallises out. Sulphate of iron, or ferrous sulphate, occurs in pale green crystals, and may also be obtained by dissolving scrap iron in dilute sulphuric acid. It is used in dyeing, ink-making, colour making, and in the manufacture of fuming or Nordhausen sulphuric acid. It is one of the cheapest chemicals in existence, but it is always a marketable commodity.

Use of American Whitewood.—American whitewood readily takes any kind of water or spirit stain, and a further advantage is that it takes a good polish. Whether the wood is suitable for furniture depends largely on the usage the furniture will have to bear, as the wood is easily dented when knocked by any hard object. The more prominent or exposed portions of the furniture should be of a harder wood. The ample width and freedom from knots of American whitewood renders it particularly adaptable for furniture that is not likely to be subject to hard wear, as from frequent removals; but the wood is of plain figure, and on large surfaces has a rather tame appearance.

Stresses and Scantlings for Roof Truss.—Fig. 1 of the accompanying illustratious shows the frame diagram of a roof which is a tied collar beam truss. Fig. 2 shows the etress diagram for verticalloading, which is the common method, the totalload being taken at ½ cwt. per ft. sup. It is, however, more correct to take the wind as acting on one side only, as in Fig. 3, and then this gives three conditions of the truss—(1) fixed both sides, (2) fixed

piece of wood or bone until the stains disappear; theu well rinse in clean cold water and hang the carpet up to dry. Or, instead of salts of lemon, oxalic acid, followed by a very weak solution of chloride of lime (bleaching powder), may be used; this is suitable for very light coloured carpets. One of the best methods of reviving all-wool carpets is to wips the surface with a large swab of soft cloths or with a very soft bristle brush, well charged with a solution made by dissolving an oxgall in a pail of water. The oxgall can be procured from a butcher's. Before using the solution the carpets should be well brushed or beaten.

Determining Capacity of Cask.—To determine by measurement the capacity of different sizes of casks, multiply the circumferences of the top, bottom, and belly of the cask separately by 7 and divide by 22 to produce the outside diameter in each case. Then subtract double the thickness of the stave to produce the inside diameter. Add the three reduced dlameters together and divide by 3 to produce a mean diameter. Multiply the mean diameter by itself and the product by the height or length (inside measure) and divide by the factor 353, and the answer will be imperial gallons. The length of the two chimbs (that is the part projecting



only on side next wind, (3) fixed only on side opposite wind. The stress diagrams for these three cases are shown in Figs. 4, 5, and 6. Taking the maximum stresses found nnder all conditions as in Fig. 7, and allowing li cwt. per sq. in. compression on the timber, and 4 tons per sq. in. tension on the iron, the scantlings will be as marked in Fig. 7.

Nut-brown Oak Stain for Picture Frames.—
The dark nut-brown oak stain used on picture frames may be made by dissolving one pennyworth of bichromate of potash in 1 pt. of rainwater; then add as much vandyke brown as will give the desired colour in two applications. The potash solution turns the wood darker without any colour pigment; this should be borne in mind, and experiment be made on any odd pieces of similar wood before the preparation is used on the finished article. Burnt brown umber also gives a useful shade, or, if desired, a portion of each may be added to the potash. In application, the wood being quite clean, the stain is brushed on rather liberally, and then well rubbed in with rag; wipe off the surplus, and always finish in the direction of the grain or long way of the wood. of the wood.

Removing Stains from Carpets.—Stains of a rusty colour can be removed from a Wilton carpet in the following way. Place a large dinner plate or tray underneath the stained portion. Mix equal parts of cream of tartar and citric acid (this can be bought ready mixed under the name of salts of lemon), saturate the stained portion with hot water, and rub on the salts with a smooth

beyond the head) and the thickness of both heads must beyond the head) and the thickness of both heads must be ascertained and deducted from the outside length, and advantage must be taken of any holes in the head or sides to procure these measurements, and if there is a hole in the bellied stave midway between the two ends, take the diagonal by means of a rod, measuring both ways, and get a mean between the two measurements in inches and tenths. Multiply the cube of the mean diagonal by 3 and divide the product by 1,331; the answer will be the contents in imperial gallons.

Making Manganese into Blocks.—Manganese for batteries is usually in the form of small granules. If required, the manganese may he made into blocks by powdering and mixing it with a small quantity of treacle, pressing in iron moulds, and then heating the moulds and contents in a furnace until all the volatile matter has passed off. This will leave the manganese cemented into blocks by carbon. Another method is to mix the manganese with 10 per cent. of clay, make into a paste with water, mould, and burn in a furnace.

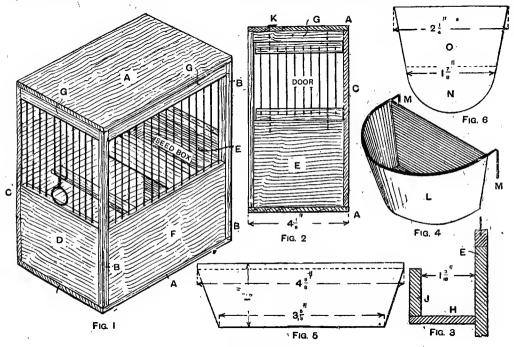
Colouring Vaseline Green.—The so-called aniline colours soluble in oils would be the most suitable for colouring vaseline green; these colours may be procured in all varieties; a green could be obtained either from green alone or by blending a blue and a yellow. The vaseline should be melted by gentle heat and a very little of the colour stirred with it till thoroughly dissolved. Most of the colours are not destroyed by carbolic acid; it is probable they will be improved, but this can be tried on a small scale first.

Small Birdcage.—Below is a description of a linnet cage simple to make. It is 6\(\) in. wide, \(\) in. deep, and 7\(\) in. high, and can be made from deal or pine, the outside heing usually stalmed green. No dovetailing or rebating is required, all the joints heing butt joints. The top and bottom \(\) are \(\) in, thick, \(\) \(\) in. long, and \(\) it in. wide, they are connected at the front by two pieces B, 7\(\) in. long, \(\) in. wide, and \(\) in. hick, and at the hack by a piece C, which is 7\(\) in long, \(\) in thick, and 6\(\) in wide. The side D is 3\(\) in. wide, 3\(\) in deep, and \(\) in thick, and is fixed by tacks through the upright B and the back C. The opposite side E (see Figs. 1 and 2) is 3\(\) in. deep, and the front F is 5\(\) in. long, 3\(\) in. deep, and \(\) in. thick.

at the bottom, and lin deep, plus about fin. for the beading at the top. This is bent to shape (see Fig. 4), the fin. heing bent round to take the thin wire M for fixing the pot to the cage. The piece for the front and the bottom is shown in Fig. 6, and is bent across the dotted line, so that the part N is the bottom and 0 the front. It is 2 in. wide at the top, and lin. wide at the dotted line, the curved part being lin. deep, and the other part 0 to dotted line line in deep. It is soldered to the semicircular portion. As mall pediment may be run round the top, and an ornamental heading round the bottom.

Material for Filling Deck Cracks.—For filling seams of decks there is nothing better than marine glue of good quality. Do not overheat it or use any grease in caulking the seams, or the glue will not adhere.

Tobacco Manufacture. — Tobacco as imported is already cured, so that but little requires to be done to prepare it for use. Abroad, the plant is gathered and hung up in hunches in a large shed to dry. After drying to a certain extent, the doors of the shed are opened during a damp day, so that the leaves become moist and can be handled without breaking. The bunches are then



Small Birdcage.

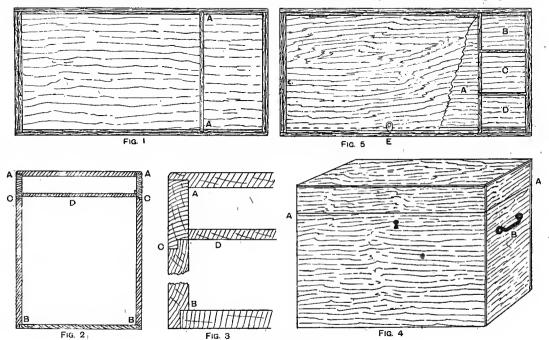
Under the top A are fixed three strips G, ½ in. deep by ½ in. thick, into which the wires are fixed. The two side strips are 3½ in. long, and the front one 5½ in. long. The seed trough is formed by fixing two pieces the shape shown in Fig. 3. The bottom part H is 1½ in. wide, 3½ in. long, and ½ in. thick, and the front J 1 in. deep, 3½ in. long, and ½ in. thick; both pieces are fixed by tacks through the hack, the front, and the side. The wiring can be done before the strips G are inserted. The wiring can be done before the strips G are inserted. The wires are fixed in the pieces G, and then let into holes drilled in the sides and the front. About 13 ft. of wire will be sufficient. Twenty-three pieces, 4½ in. long, should be sufficient. Twenty-three pieces, 4½ in. long, should be sufficient. Twenty-three pieces, 4½ in. long, should be front wires and eight at the left side, are of the same length (see Fig. 1); the three centre ones are cut to suit. The door consists of two pieces, ½ in. deep, ½ in. thick, and 3½ in. long, joined by wires, as shown in Fig. 2. All the wires for the door, excepting the two long ones shown, are about 3½ in. long. The others are longer, the right-hand one to form the hinge, and the front. No movable tray is shown, but this can be inserted if required. The water-pot is shown complete by Fig. 4, and 1s made of tin, the side L being cut to the shape shown in Fig. 5. This is 4½ in. wide at the top, 3½ in. wide

removed, piled in a pit, and allowed to ferment; again opened out to the air to stop fermentation, and packed for export. On arrival in England, as the tobacco has become too dry to handle, it is damped, and the stems and midribs are cut out. The leaves are then pressed into shreds. The cut material may then be dried to some extent by placing in canvas bags and blowing cold air through it. This is not always done, the tobacco being sold as it is, containing 20 per cent. or even 30 per cent. of moisture. Cake or plng tobacco is, of course, pressed without cutting. Sometimes sugar is added, though this is helieved to he illegal. Sailors sometimes make plug tobacco by moistening the leaves with rum to soften them and then wrap them up in a cloth, making a roil which is tapered at both ends. This roll is hound tightly with string, which is unwound and drawn tighter from time to time until the leaves are supposed to be properly cured; the roll is then cut up as required. It is very good tobacco. Good tobacco leaf, on burning, yields a smoke which is free from the acridity usually found in the smoke from plants. It is mild and fragrant, and does not affect the lungs so much. Then, again, the nicotine which the plant contains is volatilised, and in small quantity produces a soothing effect which cannot be got hy the use of any other plant, with the exception of the harmful opium.

Fisherman's Box.—Very convenient dimensions for the watertight fishing box here described in detail would be length, 15 in.; width, 9 in.; and depth, 12 in.; a box of this size would be found to be fairly comfortable when used as a seat. The box may be made of pine full \(\frac{1}{2} \) in. thick, or of \(\frac{1}{2} \) in, mahogany, which will clean up to \(\frac{2}{3} \) in. thick when finished. Prepare two pieces for the front and back 15 in. long by 12 in. wide, plane them up and square the ends, then work a rebate on the bottom edges and at the ends \(\frac{1}{2} \) in, deep and of a width equal to the thickness of the stuff. The ends are next prepared and cleaned up to 12 in. by \(\frac{2}{3} \) in, and a rebate is worked on the bottom edge. Now cover the joints with some good glue, then nail the sides on to the ends with \(\frac{2}{3} \) in. brads or panel pins. If the box is to be provided with a partition as shown by \(\frac{1}{3} \) if the box is to be provided with a partition as shown in the illustrations half-lapped together. The joints are shown in the illustrations half-lapped together, but of course a better job would be made by dovetailing them. When the glue is thoroughly dry the nails are punched in below the level and the joints cleaned off

at the front, or a pair of hooks and staples may be used instead. The box can be either painted and varnished or polished, but if finished with French polish, it will be advisable to give a coat of copal or good carriage varnish to keep out the wet. Strap staples B (Fig. 4) for screwing on the ends may be obtained from a harness maker or an ironmonger, or a handle may be fitted to the centre of the lid; but a handle is in the way when the box is used as a seat.

Measurement of Stairs.—Measure stairs by the foot super, handrails by the foot run. The shape of stairs makes no difference in the measuring, but it does in the pricing, all wreathed work being priced at four and a half times straight work. Winders may be measured net or square; whichever method is adopted should be stated in the description column. In order to measure net, add the width of the tread at the wide and to the width at the narrow end, and divide by 2; add to the product the height of the risers, and add lin. for nosing; multiply the sum by the length between the strings plus the



Fisherman's Box.

with the plane. A piece of stuff equal to the size of the top is next prepared and rebated $\frac{1}{16}$ in. all round to fit in as shown at A in Figs. 2 and 3, then the edges are coated with glue and the lid is nailed on. The method of fitting the bottom into the rebates prepared in the sides and ends is shown at B (Figs. 2 and 3), and when this has been nailed in and the box is dry, the box may be cleaned off with the plane and sandpapered up. A marking gauge is now set to $\frac{1}{2}$ in. and the line for the joint of the lid is scribed on as shown at A (Fig. 4), and the box may be cut in two along this line with a fine-toothed tenon saw. In Figs. 2 and 3, a rebated joint is shown between the lid and box at C, the object of this being to keep rain from penetrating; but to fit the lid on in this manner it will be necessary to make the parts separate and fit them together. The partition dividing the body of the box at A (Fig. 1) may now be fixed and the lid, if desired, fitted with a tray and partitions for carrying fishing tackle. A useful arrangement for this is shown by Fig. 5. The inside of the lid is divided into convenient compartments for hooks, lines, etc. Fig. 5 gives a view looking luto the lid when open, and a portion of the flap is broken away at A to show some of the divisions B, C, and D. The flap may be secured as shown at E with a turnbutton made out of a piece of $\frac{1}{2}$ in. brass plate secured with a round-headed No. 6 wood screw. The lid can now be hung to the body of the box with a pair of 2-in. by $\frac{2}{2}$ -in.

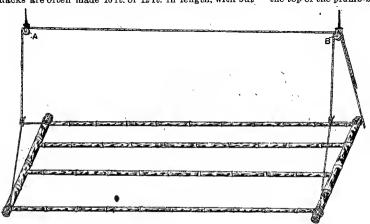
housings if close, out to out of cut strings, and multiply this by the number of steps and add one rise for the landing. In order to measure square, take the width of the winder at the widest end, add the rise plus lin. for nosing, and multiply by the length; multiply this dimension by the number of steps. If the risers are tongued, neasure the tongues by the foot run, and describe as one edge or two edges, as the case may be. If the treads are jointed and feather-tongued, describe them as such. For the strings, measure the length on the top edge with tape; multiply by the breadth, describe the thickness, and state whether plain sunk, or double sunk and moulded, whether laminated, backed and staved, or built up; state whether mitred to risers, whether glued, blocked and nailed, or screwed, and whether balusters are dovetailed; specify carriages by foot run. For the handrails, measure the run on the back of the rail with tape, add 4in. for housings if finishing in newel post or balusters or grooved for core. Enumerate the caps and handrail screws.

Silicate of Soda.—Soluble silicate of soda is made according to one method by heating a mixture of 60 parts of white sand, 33 parts of soda ash, and I part of charcoal in a reverberatory furnace. The silicate also is produced by heating powdered fiint with a concentrated solution of caustic soda under pressure. The second method produces a thick solution like syrup, and a similar solution is prepared in the first method by boiling the melt with a little water, decanting the clear syrup.

Staining Glass.—Stained glass is produced by several methods. For ordinary stained glass, metallic oxides are added to the usual ingredients of white glass. Ruby glass is formed by the addition of oxide of copper, and heating the glass in a reducing atmosphere; or it is produced by the addition of finely divided gold. Oxide of copper is also used in the production of green glass, while amber-coloured glass is obtained by the help of antimoniate of lead. Another kind of stained glass is prepared by dipping a ball of pasty glass into a bath of molten coloured glass, and then blowing the two together: this kind of glass is known as flashed glass, all the colour being contained in a very thin tinted film spread on the surface of whits glass. Stained glass is also often produced (for artistic purposes) by painting fusible enamels on the surface of ordinary glass, and then burning in the colours in a muffle furnace; stained glass windows are produced in this way. The ordinary coloured lacquers may, of course, be used for staining glass, but they give a very poor and dull effect.

Bamboo Clothes-airer. -The lillustration shows a Bamboo Clothes airer.—The 'illustration' shows a clothes airer either for domestic or laundry use, its size being 6ft. 6 in. by 3ft. Besides being lighter it is also not so unsightly as an airer made in wood. The two end pieces should he of 2 in. bamboo, 3ft. long, and the rails are 1 in. thick by 6 ft. 6 in. long. The sketch shows four rails, though five or six need not be considered too many. Racks are often made 10 ft. or 12 ft. in length, with but that the cutter may work plumb, this leg being used as the cutting leg and filed to the shape of an inverted A; the cutter should be the bare width of the stringing, which should in all cases fit tightly into the grooves, but not so tightly as to chip the top edges and cause the work to lack a clean finish. The corners should be mitred and the metal fit in the channels without buckling up. When inlaying wood, stringing is commonly practised in order to clear the channels to such a depth that the inlay will staud slightly above the surrounding surface, so as to allow for cleaning off and glass papering, but this practice should be avoided as far as possible in the case of metals lest particles of metal should be forced into the grain of the wood. Glue is generally used for securing the inlay in position; a thick solution of shellac dissolved in wood naphtha is considered by some workmen to be better than glue. Fine pins driven through the metal in a slanting direction afford greater security than glue or shellac if long lengths of metal are used; pins are also preferable in the case of shields or centrepieces. nieces.

Improved Plumb-bob.—In the plumb-bob here illustrated, the point of superiority is that there is no difficulty in keeping the string from getting entangled. The bob contains inside a small drum pivoted on a piece of fairly stout indiarubber cord. The string is wound round this drum and passed through the plug on the top of the plumb-bob. The string is then knotted to



Improved Plumb-bob.

Bamboo Clothes-airer.

three rails. Generally, the longer the rails the less the number required. The rails should be plugged with wood about 6 in. and well glued in. The thicker plees are bored about 2 in. from the ends, and equal spaces are allowed between the rails, the ends of which are rasped and tightly fitted into the holes. They are then glued in and cramped up with strings. Before removing the strings, the end pieces should be bored and countersunk for 3-in. screws, which are driven into each end of the rails. The rack next requires plugging at the corners, and terminals should be put on: Varnish well where the rails are let in to prevent any moisture from the clothes softening the glue. A single pulley A and double pulley B are required, and can be hought at any ironmongery stores very cheaply. Two 4-ft. 6-in. lengths of rope are cut off, the ends being tied to each corner of the rack and the remainder divided and attached as shown. To find the joists in the ceiling for the pulleys, it will be necessary to examine the floor of the room above and measure from the wall. The ropes are then put through the pulleys and bound together as shown with strong cord. When pulled np, the rack should be about 6 in. from the ceiling. It is kept up by the hand rope being wrapped round the cleat-hook, which may in most cases be screwed to the woodwork of the window framing.

Inlaying Pewter and Copper in Oak.—Below are hints on inlaying pewter and copper in oak. If the inlaying takes the form of plain banding the metal should be bought ready cut; uniform width of the band is thus assured, as the metal is cut by roller cutters in a machine. The channels for the reception of the metal should be of equal depth all through. The lines are cut with a tool resembling a joiner's cutting or marking gauge, the space between the lines being cleared out with a ronter. Oircular or semicircular grooves are cut with a strong pair of joiner's wing compasses, which can be secured by a set screw, one leg being bent in order

keep it from going right in. When in use, pull the string out and this will twist the indiarubber; then when released from the weight of the plumb-bob itself, the string will fly back into the inside and thus prevent entangling. The drum need only be of tinned iron, and the plug at the top should be screwed with a ½-in. gas thread.

Slating Westmorland Roof.—The method of setting up the laths and holing the slates for a grey Westmorland roof is as follows. Sertout the slates into graduated lengths, then suppose them to be head-nailed and to have a lap of 3 in.; the margin for the first course and the position of the batten or lath will be found as follows:

| Length of slates in first cou Length of slates in second | rse, say course, say | | 26 25 |
|---|-------------------------|-----------|-------------|
| Net lap required Nail hole to head of slate | Differenc | e = - | 1 3 1 |
| Length of slates in first of 21 in. | ourse 26 in. | less | 5 in. |
| 21 divided by 2 Add difference of length | | | 10½ 1 |
| Gives margin of first course Add net lap | | | 111 |
| Gives centre of first row of | battens | | 141 |

The battens for the second course will be $14\frac{1}{2}$ in., less difference in length of slates 1 in. = $13\frac{1}{2}$ in. from the last batten centre to centre, and the spacing for the remaining battens will be found in a similar manner.

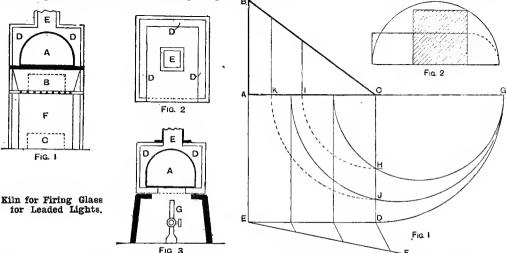
Boring Holes in Bamboo.—Ordinary centre-bits as employed in woodworking may be used for boring holes in bamhoo poles where the holes are small in comparison with the pole in which they are to be made. But as the hole to be bored approaches, in diameter, to the thickness of the pole itself, centre-bits do more and more unsatisfactory work, unless the hollow middle of the pole is filled with wood, and this, of course, is only possible near the ends of the pole. Bamboo workers get over the difficulty hy theuse of a bit specially modified for hamboo fitting. A short twist-bit of Jennings' pattern is procured, and the screw centre-point of the bit is filed down to a triangular pointed shape. This is done because the unaltered bit feeds itself too rapidly and invariably splits the work; but with a plain triangular point the feed rests with the operator alone. Even then the centre-point is apt sometimes to etart a split, and in very particular work the precaution should be taken of boring a bradawl hole first, especially when a large hole has to be made near the end of a pole.

Kiln for Firing Glass for Leaded Lights.—A kiln suitable for firing glass for leaded lights may use either coal or gas. A kiln for use with gas and one for coal are very similar in construction. The illustrations show both forms in section and in plan, and the arrangement of the flues may be seen. The furnaces are of the kind known as muffle furnaces, the muffle A being used as a chamber for firing the glass.

that are very objectionably glossy may be improved by very gently dabbing or rubbing the affected parts with a chamols leather dipped in water. This method can only be used with papers that are printed in various shades of one colour. Moistening the chamols leather with steam from the kettle is the safest method.

Equal Division of Triangular Piece of Land.—A triangular piece of ground, the sides of which are 60 chains, 80 chains, and 100 chains long respectively, is to be divided into three equal parts, all the parts to have equal areas. First test triangle in order to see whether the 60-chain end is square to the 80-chain side, thus $80^2 + 60^3 - 100^2 = 0$, or 6400 + 3600 - 10000 = 0, proving the angle to be a right angle. Now the area of the whole triangle will be $\frac{60 \times 80}{2} = 2400$ sq. chains, which is the content of the plat that is to be divided into three equal content of the plot that is to be divided into three equal parts, each part containing 800 sq. chains. Measuring from the apex, double the distance will contain four times the area, or the area varies as the square of the distance. If 80 chains distance gives 2400 sq. chains, then 2400, 80°, 800, or $\sqrt{\frac{80^2 \times 800}{2400}} = 46.19$ chains for the 2400

first division line from the apex. Then $\sqrt{\frac{80^2 \times 1600}{2100}}$ 65.32 chains for the second division. Geometrically the



Equal Division of Trlangular Piece of Land.

Furnaces for use with coke are built of fireclay bricks puddled with fireclay; the gas furnaces are constructed of fireclay slabs bound with hoop iron. The illustrations show in Fig. 1 a section of a coke muffle furnace; in Fig. 2, a plan of a coke muffle furnace; in Fig. 3, a section of a gas muffle furnace; the letter references are A, muffle; B, stoke hole; C, ash hole; D, flues; E, chimney; F, ashpit; G, gas burner.

F, ashpit; G, gas burner.

Wood Preservative.—The following preparation is excellent for preserving exterior woodwork, such as railway sleepers, posts; rafters, etc. Dissolve by frequent agitation 141b. of coal-tar pitch in 1 gal. of benzine, and stir well into 12 gal. of anthracene oil. In another vessel dissolve 21b. of pure rubber in 1 gal. of solvent or coal-tar naphtha, and then add 4 gal. of carbolic acid. Mix the contents of both vessels thoroughly. The preservative should be applied with a brush. It is very effective alike against the action of dry rot, decay, and dampness in all woodwork, and the cost of it is very small

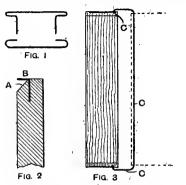
Wall Paper Showing Glossy Patches.—The reason of wall paper showing glossy patches along the seams and at other places where the brush and roller have been used is that the paper has been printed with an aniline colour. Papers printed with fugitive colours of this type show a glossy surface when submitted to friction; this is one of the chief objections against papers of this class. Pigment or mineral colour papers are slightly duller in appearance than aniline papers, but are free from this glossiness. Many attempts have been made to overcome this defect, but up to the present without success. The mordantused in fastening the dyes is one of the principal causes of glossiness, which can only he avoided by the greatest care in hanging and handling the paper. Parts of the paper Wall Paper Showing Glossy Patches.-The reason

division would be obtained as follows (Fig. 1). Draw the triangle ABO; upon the side from which the divisions are required draw the square CDEA. Trisect line ED by the usual method for dividing a line into any number of equal parts, and draw division lines. Turndown CD into line with AC, bisect the distance from G to the first division, and describe a semicircle cutting CD in H; from C with radius CH describe the arc HI, and a vertical from I will be the first boundary. Bisect the distance from G to the second division, describe a semicircle cutting CD in J, describe the arc JK, and a vertical from K will be the other boundary line required. The principles involved in this solution are, first, that the areas of similar triangles vary as the squares of like sides; and second, the construction of a square equal in area to a given parallelogram, which is shown in its simplest form in Fig. 2.

Water-hammer in Pipes.—This is caused by suddenly arresting the flow of water through the pipes. In service pipes water-hammer is caused by suddenly closing a draw-off cock out of which water is flowing. The same noise is heard in the drive pipe of an hydraulic ram when the working valve is dashed up to its seating; also in the delivery pipe of a pump when the pump is worked at too high a speed and is without an air-vessel. In the case of a draw-off cock as possible; the same remedy is suitable for a pump delivery pipe. In the case of an hydraulic ram an air-vessel should not be attached to the drive pipe, as the shock caused by suddenly arresting the flow of water is necessary to the working of the ram. An air-vessel is used for the purpose of slowly arresting the flow of water through the pipes, and thus preventing shock or water-hammer. Water-hammer in Pipes.—This is caused by suddenly shock or water-hammer.

Faulty Chain of Lever Watch.—When the chain of an English lever watch turns over on the barrel it shows its badly strained. Take the chain off, straighten it out perfectly, and gently tap all the rivets over a flat steel stake. Reverse the hooks, putting the barrel hook on the fusee end of the chain, and see that the surface of the barrel is flat and smooth. Then put the chain on again, and if the fault is not remedied, a new chain will have to be fitted.

Binding Loose Book Parts, etc.—The binder here illustrated affords a means of binding together parts of periodicals, etc., at a cost per volume of about a farthing. It consists of a backboard having two wire staples, as shown by Fig. 1, top and bottom, to which the papers are laced with twine. The backboard is a piece of wood of the same length as the papers, and the width is equal to the bulk of papers when pressed together by the hand. On the inside face is a slight bevel A (Fig. 2) at each end for passing the twine between the board and the staples B, and on the outside the sharp edges, lengthways, are rounded off. The staples may be made of stout hairpins twisted into a chain ring, the length of which, when completed, should be \(\frac{1}{2}\) in less than the width of the board, and about \(\frac{1}{2}\) in. wide, the free ends being turned up, as the staple lies flat, at right angles, at about \(\frac{1}{2}\) in. from the bend, and then driven into the wood at each end; the long side is flush with the inside face of the board, leaving a narrow opening. The book parts, papers, etc., may be bound singly as they come to hand. First tie the twine to one staple, and placing a paper with the hack of the fold to the board, pass the twine down



Binding Loose Book Parts, etc.

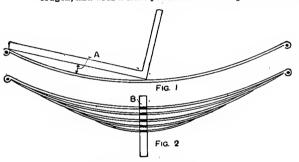
the inside and lace it to the other staple; then another paper may be placed, and the lacing commenced where the other left off. Keep the twine taut while binding. A temporary fastening may be made by drawing the twine in a loop through the staple, inserting in it the free end, and drawing tight. A wire hook will assist in lacing, and in adding twine let the join beinside the fold for neatness. Fig. 3 shows the binder with one length of twine C attached, the dotted lines representing the periodical. Two holes bored in the backboard about 4in. from each end, and a string passed through and tied inside, will be a convenience for handling the set until the volume is complete, when it will pass to the bookshelves. The sides can have covers added on completion, and may be embellished according to the taste and skill of the owner by woodcarring or leatherwork, or any of the faucy needlework.

Hardening Plaster of Paris. — Plaster of Paris moulds are made much harder if alum he dissolved in the water which is used for mixing, also by steeping the moulds in skim milk and then drying. A very hard material may be made by curdling skim milk with a little acid, collecting the curd on a cloth and pressing out the whey, then dissolving the curd in a solution of about one fourth its weight of borax in water. This solution should be used for mixing with the dry plaster-of-Paris for making the moulds.

Avoiding Bust on Cycle Frames.—The borax used in brazing the joints of cycle frames, being of an alkaline nature, will quickly eat into the metal and cause the work to rust rapidly beneath the surface of the enamel, which eventually falls or cracks off. The alkali may, however, be neutralised by sponging the parts over with dilute sulphuric acid or vinegar, finally washing or sponging off with warm water and well drying. Should there be the least sign of rust on any part of the tubing, apart from the brazing, this may be completely

obliterated by thoroughly soaking and rubbing the metal with benzine and emery paper. The impurities in the composition of the metal would have no effect on the subsequent coat of enamel after the work had been thoroughly cleaned. The fiint-like nature of the enamel would imprison any acid or chemical in the metal, the ruet not being able to form unless the work had, previous to enamelling, been allowed to rust slightly. Rust when once promoted, no matter from whatever cause, will rapidly accumulate above or beneath any surface. Acids and alkalies produce rust more rapidly than any other known matter. known matter.

Setting up Carriage Spring.—Below are some hints on setting up a carriage spring that has been strained by over-weight or accident. First it will be uecessary to find how much the spring requires setting up. Suppose this amount to be 2in. Next take the spring apart from the carriage, and put it on the bench or fitting plate; place a straightedge across the top of the eyes, and measure the compase from the top of the back plate to the straightedge, and note the measurement with the weight off. In ease of an elliptic spring, measure the inside span before taking the two halves apart; then take these apart, and measure separately the compase of each half, as sometimes one half is strained more than the other, and consequently will want more setting up than the other. However, both halves should be of equal compass. Next fix the spring in a vice, and take out the centre bolt, putting a piece of ½in. rod through the hole to prevent the spring falling apart. Next put the spring on the bench, and press all the plates up to each other eo that the ends touch. Next take a piece of ½in. rod chrough cooper's hoop iron, about 8 in. or 9 in. long, and lay it across the centre of the spring at right augies to its leugth, and with a slate pencil mark the top and bottom



Setting up Carriage Spring.

edge of each plate. See whether the spaces between the plates are regular, that is, with the widest space between the back and second plate, and the width diminishing as the plates get shorter. If not, they must be made so in setting up the spring, otherwise the strains on the plates will he unequal. Next make a dot-punch mark on each plate, so as to get the plates in their right places, and note that a chalk mark on the dotted ends while working at the apring, will save looking for the dot. Next set up the spring, taking the back plate first. If it is fairly regular, the sweep of the plate can be marked on the fitting plate, and a mark made line above each eye will be all that is necessary. Next heat the spring plate black hot, taking care not to overheat it, or it will have to be hardened and tempered again. Next place the plate across the vice, and with a few blows with the hammer; compass the plate, till it touches the marks referred to. To find whether one half has got more compass than the other, a 2-ft. iron square is handy. Place one end against the centre hole, and the other along the top of the spring plate, as shown at A (Fig. 1). Having got the back plate true and etraight by a few blows on the edge, if necessary take the plates in turn and fit them, making each plate come up to the marks on the hoop iron B, as shown by Fig. 2. The spring is set up it is generally stiffer than it was before, and when it gets the weight on it again it will not go down so much. Therefore the carriage is sometimes higher than necessary, and requires swaging down; or the spring must be taken apart, and some of the compass taken out of it.

Cleaning Brass Door-knocker.—To clean a brass door-knocker that has become very black, take out the iron screws, and thoroughly clean the knocker in strong soda, brushing all dirt out of the indentations of the pattern. Then dip in sulphuric acid polish with emery and oil, and finish off with crocus powder.

Fireproofing Chinese Paper Lanterns.—Chinese paper lanterns might be treated so that they would not hnrn, yet, if a fiame came in contact with them, they would certainly char; there is no method of rendering organic substances like paper fireproof. Painting the lanterns all over with a strong solution of tungstate of soda would render them uninflammable, but it is probable they will not stand this treatment.

Calculating Radii of Large Circular Curves.—
The following simple rule can be used for fluding the radii of large circular curves, the centres of which are inaccessible. Place a straight rod, exactly 2ft long, in the curve as a chord (AB in the accompanying illustration), and measure the rise of the curve at the centre of the rod (CD in the figure). Express this rise as the fraction of a foot, add it to the same fraction inverted, and the result will be the diameter of the circle in feet; therefore, the radius will be balf that result. Suppose the rise is 1 in.—that is, \(\frac{1}{1} \), of a foot; that added to the same fraction inverted \(\frac{12}{1} + \frac{1}{12} \), equals \(12\frac{1}{12} \), or 12ft. 1 in.. which is the diameter, and the radius is Same fraction inverted $\frac{1}{1} + \frac{1}{12}$, equals $12r_2$ ft., or 12ft. 1in., which is the diameter, and the radius is 6ft. 04 in. But an objection to this rule lies in the fact that, although it works out very nicely in a few particular cases, like $1\frac{1}{2}$ hn., which is $\frac{1}{4}$ of a foot, etc., it becomes troublesome when the rise represents an awkward fraction of a foot, as, for instance, the rise of $3\frac{1}{4}$ in., which is $\frac{1}{4}$ of a foot, or $5\frac{1}{4}$, which is $\frac{1}{4}$ of a foot, or $0\frac{1}{4}$, which is $\frac{1}{4}$ of a foot, These are inconvenient enough, while those rises which include an odd $\frac{1}{4}$ in. or $\frac{1}{4}$ in are worse still. Another method will, therefore, now be shown. Notice the following table, to use which it is only necessary to measure the rise on a 2ft, chord and then find the radius from the table.

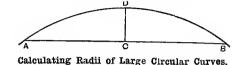


TABLE OF RADII, CORRESPONDING TO RISES AT THE CENTRE OF A 2-FT. CHORD IN CIRCULAR CURVES.

| Rise. | Radius. | Rise. | Radius. | | | |
|-------------------------|---|------------------|---|--|--|--|
| in. | ft. in. 96 32 48 75 | in. 4 5 | ft. in. 1 8 1 4& | | | |
| o न्दैर्भ कोक न्दं र को | 96 12 48 16 24 18 16 18 12 18 | 6 7 8 9 | 1 4.8 1 3 1 1 11 1 1 1 04 | | | |
| 1 2 3 | 6 1 3 1 2 1½ | 10 11 12 | $\begin{array}{cccc} 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 &$ | | | |

A little observation of the above will disclose a curious fact. In the first radius column the feet are inversely, and the inches directly, proportional to the rise; that is, as the rise increases, the feet in the radius decrease while the inches increase, all in the same proportion, and vice versa. This does not apply to the right-hand columns. Compare !-in. rise with 1-in. rise; the rise is doubled, the feet in the radius halved and the inches doubled. It will be further noticed that the inches in the radius are exactly half the rise in every case in left-hand columns. To show the utility of these facts, suppose the radius for a 7-in. rise were not in the table and that it is desired to discover it. Since 7 in. is seven times 1 in., look up the radius for 1-in. rise, and divide the feet by 7, and add half the rise, thus:—

6tt. divided by 7 = 10; in.

Half the rise = 31 ...

Equited radius = 1ft. 114 in.

Required radius = Ift. 1}1 in.

Reference to the above table confirms this result. Reference to the above table confirms this result. So that for any rise which does not appear in the table, the radius can be rapidly calculated from that of any tabulated rise (in the left-hand column) of which it is the most convenient multiple or factor. Take, for example, a rise of $1\frac{1}{2}$ in.; this is 3 times $\frac{1}{8}$ in., the radius for which, taken from the table, is 16 ft. $\frac{1}{2}$ in.

16 ft. divided by 3 = 5 ft. 4 in.

Half rise = $\frac{1}{2}$ in.

Required radius = 5 ft. 4_{16}^{9} in.

As an example of obtaining a radius for a small rise, from that of a larger rise, take & in. rise, using 1 in. rise

(as per table). Since the rise is smaller, the feet must be increased,

6 ft, multiplied by 6 = 36 ft, 0 in.
Half the rise =
$$\frac{1}{1^2}$$
 in.
Required radius = 36 ft. $\frac{1}{1^2}$ in.

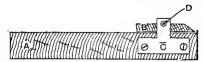
The range of radii which can be discovered by this simple rule is very large. For curves less than 1 ft. radius, or for very large curves, where measuring the rise on a 2.ft. chord becomes impracticable, any chord may be taken, and the following rule used. To find radii: Take half the chord, equare it, divide by the rise, add the rise, and finally divide by 2. This rule formulated is: $\frac{\left(\text{Chord}}{2} \right)^2 + \text{Rise}$

$$\left(\frac{\text{Chord}}{2}\right)^2 + \text{Rise}$$

The same rule can be used to find a radius of a segmental arch, of given span and rise, by substituting the word "span" for the word "chord," as Take half the span, etc.

$$\left(\frac{\text{Span}}{2}\right)^2 + \text{Rise}$$

Photographic Mount Beveller.—Commercial mounts must be of stock sizes, and when a print is trimmed to a suitable size and shape, it is often impossible to fix it on one of those mounts, owing to the margins being unequal. In such a case the only thing to do is to make a mount to snit the picture. A bevelled edge always enhances a mount, whether home-made or otherwise,



Photographic Mount Beveller.

but it is not always possible to make a clean bevel with the knife and straightedge unless the worker is accustomed to the use of these tools. The accompanying illustration, however, shows an apparatus which renders failure impossible. A baseboard A of wood has the front edge faced with brass, which should be raised about \$\frac{1}{2}\$ in above the top. A strip B of wood, of the same length as the baseboard, is bevelled as shown, the bevelled portion being faced with brass, which must be smooth and even throughout its length. There must be no screws or nails protruding. Two brass T-shaped pieces C will be required with a hole drilled at the top of each. These pieces are screwed to the ends of the baseboard, and a pin D is screwed to B, and passes through the top holes. Two of these pins are required. A thin, narrow strip of wood may be screwed to the base at the far end, but it must be kept clear of B. This strip acts as a stop, and must be at aright angle to the front edge of the base. To use the beveller, the card, after having been cut equare, is pushed under B, against the brass at the front of A, and against the thin strip of wood. The front of B is pressed down on the cardboard with the left hand, and by using a sharp knife pressed against the brass, a stroke from end of of the cardboard cuts away the exposed edge and makes a clean bevel. One edge is cut at a time, but all four edges will be of the same depth if care is taken to keep the knife flat against the brass. An ordinary penknife will do, but a shoemaker's knife is best for the purpose. The arrangement here described could with little alteration be made useful to hook binders and paper-box makers. The whole thing might be made in metal, and B could be adjustable so that different depths of bevels could he obtained; also a rod with a stirrup could be fitted to B for holding it down on the board, so that both hands could be used to push the knife, as would be necessary if thick boards were being worked.

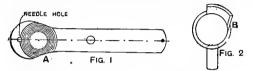
being worked.

Taking Out Clock Mainspring.—In any kind of clock in which the mainspring is confined in a barrel or a strip of brass, the clock must be run down before taking it apart. This can be done by removing the pallets and letting the train run, or, like a watch, hy holding back the click and letting down gently. In an American or German clock in which the mainspring is not confined, first wind up the clock, then pass a clamp (off a new mainspring) over the wound-up spring, or tie it with wire. Then hold back the click and let the spring down as far as it will run. The clamp or wire will then confine the spring as in a barrel. To remove a mainspring from its barrel, take hold of its centre with the pliers and twist it in the direction of winding up, to ease the coils, at the same time pulling outwards. Haudle it with a duster for safety. with a duster for safety.

Dressings for Leather Belts.—Here are hints on dressing leather belts to prevent them slipping. Grease that is applied only on the face of the belt coming in contact with the pulley will, of course, prevent adhesion. Some users of machine belts make an adhesive by mixing about 3 parts of resin with 1 part of tallow. This composition is applied hot, or in a liquid state. A solution of indiarubber, oil, resin, and tallow is also used as an adhesive. If the belt has become hard and dry, proceed as follows. Well cleanse the belt with hot water and soap, and rinse with clean warm water. While the belt is moist, rub well into it some dubbin, and let the belt dry at a tension. The dubbin may be made by melting over a fire some good tallow, and adding onequarter its weight of cod-liver oil; allow to cool, when the dubbin will be ready for use. Whenever there is a tendency of the belt to slip, brush off any dust that may be on the belt, and place a little castor oil on the side next the pulleys. Should the oil fail to have the desired effect, take the belt up to driving tension. If the belt is worked on pulleys that are too small, it will slip, unless it is very much over-strained. The following is a good dressing for leather belts. Heat to about 120° 22 lb. of indiarubber, and mix with it 2½ lb. of rectified turpentine of oil. When well mixed, add 1½ lb. of clear resin and 1½ lb. of yellow wax. Dissolve 31b. of good tallow in 71b. of fish oil by heating, and mix in it the above solution. Rub the mixture well in on both sidee of the belt. When the belt shows a tendency to slip, apply eome of the solution to the iustide, or side of the helt next the pulleys, first brushing off all dust.

Adjusting Singer Repairing Machine.—Sewing machines when sold from the shop usually are adjusted

Adjusting Singer Repairing Machine.—Sewing machines when sold from the shop usually are adjusted to work threads up to No. 25, 3-cord wax thread, for which No. 6 special wax thread needles should be used. To use No. 18, 5-cord wax thread, the following alterations will be necessary. Fit a needle plate having a larger hole than usual, or have the needle hole in the needle plate



Adjusting Singer Repairing Machine.

now in use drilled larger. See Fig. 1, which shows the needle plate from the under side. Also see that the under side A of the needle plate is milled deep enough to allow the thread to pass freely over the shuttle, and make sufficient thread passage between the shuttle and the shuttle carrier by filing the heel of the carrier; see B (Fig. 2). Be sure to smooth this part with emery cloth after filing it. Use a No. 8 or No. 10 needle, according to the substance to be stitched, and if the machine has been in use a long time, remove all nitches that have been made by the finer threads in the guides, etc., or these will have a tendency to chafe the coarse thread.

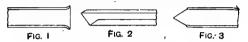
Borax Photographic Toning Bath.—Theborax photographic bath is found to be specially suitable for ready sensitised albumen paper, which is always in an acid condition, because the paper is floated in citric acid. Dissolve 80 gr. of borax in 100z. of boiling water; add 3gr. of chloride of gold to another 100z. of water, and mix the two. The prints must be washed perfectly free from silver nitrate, as usual, and toning is then proceeded with in the ordinary manner. Toning is complete in from fifteen to twenty minutes, according to the temperature. The bath must be allowed to cool before using.

Rolled Gold and Filled Gold.—As a substitute for solid gold, the most commou device is to make the articles of a base metal—generally brass—and electro-gild them. This process, in the case of articles subject to hard wear, such as watch cases, chains, brooches, etc., is of little use. The coating of gold is soft and thin, and very soon wears off on the most exposed parts. A better substitute for gold is made by coating brass or other hard alloy by mechanical means with a thin layer of hard gold. There are several methods of doing this. Some American watch cases, notably Waltham and Keystone, and some English cases, made by a Birmingham firm, are known as "filled gold." The result is a case made of hard brass, of which all the surfaces, outside and inside, are covered with a fairly thick plate of gold, calculated to wear almost a lifetime. The gold on these cases is so thick as to bear engraving without cutting through into the base metal, and when such cases, weighing 2 oz. or 3 oz., are sent to the refiners to be melted, they frequently produce 15s., showing the actual value of the gold covering. Rolled gold is mostly of German origin, and is made by brazing a plate of gold

on a thicker plate of brass, and rolling it out thin into sheet, from which the articles are then manufactured. Rolled gold jewellery is, therefore, the same as a "gold-filled" watch case, and consists of hard brass, mechanically covered with a layer of hard gold. The gold covering may obviously be of any quality or thickness. The best is equal to American gold-filled cases. The commonest made is still greatly superior to gilt goods. The cheap jewellery seen in fancy shop windows is mostly of this kind in its commonest form, while in Germany the best rolled gold bears an official stamp—like a hall mark—guaranteeing the quality of the gold covering and its thickness. Gold casing is older than either gold filling or gold rolling, and the method has been practised in England for at least a century. It consists in covering the ecompleted article with a thin gold shell and uniting the two by soft solder. In this case, also, the gold covering is thick and hard, can be engraved, and has a considerable value when the articles have to be consigned to the melting pot. The articles most commonly in use that are gold cased are pencil cases and pocket pens, the bows of watch cases, etc. Much old jewellery, brooches, bracelets, etc., are found to be gold cased after having been in wear the greater part of a century; their present owners often believe them to be of solid gold, and are undeceived only when the articles are taken in exchange for more modern jewellery, and have to be melted. "Rolled gold," "gold tilled," and "gold cased," therefore, mean that the article so described has a hard covering of gold of an appreciable thickness, and anyone selling gilt goods under the above descriptions can be proceeded against for fraud.

Welding Channel Tyres.—The following instructions are on welding channel tyres for carriage wheels

Welding Channel Tyres.—The following instructions are on welding channel tyres for carriage wheels. When the ends of the tyree are hot, thin one of the ends down, using the ball of the hand hammer or a bob-punch; by this means the end will be made to spread out, as shown by Fig. 1. For the other end, cut off the ends of the webs, as shown by Fig. 2, turn the tyre on its edge, holding it on the front edge of the anvil, and taper it off as shown by Fig. 3, thinning it



Welding Channel Tyres.

down flatways at the heat. When both ends are scarfed spring the tyre so that it will hold in position whilst getting the welding heat. Now place Fig. 3 inside Fig. 1 and heat it sufficiently to hammer the scarfs together; take the welding heat, and weld up on a bottom tool which fits into the anvil, and which is made specially for the job.

percelain or Cast-iron Baths.—There may be a difference of opinion as to whether a porcelain bath is preferable to an enamelled cast-iron bath, yet doubtless a cast-iron bath of good quality is the better for the following reasons. An iron bath is inetantly warmed by the inflowing water, because iron is a rapid conductor of heat, and in finish and general appearance an iron bath can be made immensely superior to a porcelain bath, and in all things is the cheaper of the two. An iron bath is sometimes said to cause the water to cool rapidly; but this is never noticeable when one person bathes, nor even when two children use the same water in succession.

Anti-corrosive Paints.—Medium used for anti-

this is never noticeable when one person bathes, nor even when two children use the same water in succession.

Anti-corrosive Paints.— Medium used for anti-corrosive paints is generally made from the cheapest quick-drying varnishes that can be made; those varnishes containing a large proportion of Manilla gum or common resin are the kinds mostly employed. To prepare the medium or varnish, place 4 lb. of resin in a suitable vessel over the fire, and melt with gentle heat; then move the vessel well away from any fire or light, and allow the contents to cool somewhat: 1 gal. of coal-tar naphtha should then be added cautiously and slowly while constantly stirring, and then 1 pt. of boiled linseed oil to prevent brittleness. The preparation is now mixed, whilst warm, with red oxide which has been previously ground in this medium, or in a cheap oak varnish, and then allowed to cool down, when it may be further thinned if necessary with more naphtha, after which it is ready for use. Care should be exercised with the naphtha, as it gives off a highly inflammable vapour. This paint is extensively used for all kinds of irouwork: it dries hard with a glossy surface in about four hours, and if applied hot, in about two hours. Double boiled Baltic linseed oil, mixed with the above or with a cheap oak varnish in variable proportions, forms a very hard and elastic coacting which resists atmospheric influences and sulphurous gases admirably, and which may be used on gas holders, etc., to advantage, if mixed with red lead or oxide of iron.

Finding Radius of Arch.—Here is a brief method of finding the radius of an arch of any span by figures. Let s be the span of the arch and r the rise, then the radius R will be

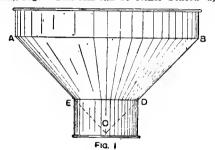
$$\mathbf{R} = \frac{s^3}{8r} + \frac{r}{2}.$$

For example, say that the span is 4 ft, and the rise 6 in.

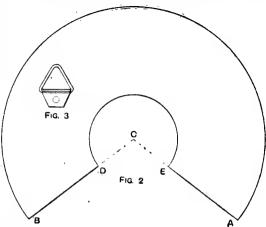
$$R = \frac{4^2}{8 \times 5} + \frac{5}{2} = 4.25 \text{ ft.}$$

rading of arch.

milk Sieve.—Fig. 1 shows a milk sieve made of tin plate with a brass ganze bottom. Such sieves are usually in three sizes, viz. "single," "middle" and "double" and the sheets from which they are cut are respectively 14 in. by 10 in., 15 in. by 11 in., and 17 in. by 12 in. In the pattern (Fig. 2) for the body, the radii C D and C B are equal respectively to C D and C B (Fig. 1). While the arc B A (Fig. 2) equals 3; times A B (Fig. 1). The plan adopted by many workers of marking out Fig. 2 for any of the above-mentioned stock sizes is to treat half the length of the sheet as the radius for the larger arc, while the radius for the smaller arc is practically three-quarters that of the required size when fluished. Working edges are, of course, additional, and should be allowed accordingly. Notch the pattern for a grooved seam, pass it several times through the rollers to "break" the metal, set off the working edges on B D and A E in opposite directions, bend to shape, and groove the seam on a suitable stake. Solder the seam inside, set off both the larger diameter and, in an outward direction, a creased edge to take the top rim, and set off the other edge on the smaller end, inwardly, for the gauze bottom to rest on. The top rim is next made, and it is cut so that its length is 3; times A B (Fig. 1), plus lap for the seam, and it is equal in width to the proposed depth of rim, plus allowance for a wiring edge. This rim can be either beaten up or



are worked up solid, that is, made from walnut or oak. The majority of American-made cases are built of ash or birch, which is stained in varying shades of brown. Most makers have a colour and finish peculiar to themselves; Estey's organs are reddish-brown, Clough and Warren's are dark brown, Doherty's are light brown, and Sterling's most closely give a walnut colour. Some cases, notably Bell's and Estey's, have pressed carved work panels, others have a lot of carved work planted on, and as this cannot be removed it is very difficult when working the cases up bright to leave the surface perfectly level on the flat parts immediately surrounding these carvings. In the factory the surface is built up of oil varnish, mostly stained, in a similar manner to planos, as explained fully on p. 131. In the majority of cases this surface is afterwards dulled by punice powder or emery: in a few instances a series of panels may he left bright. To bring up the whole of the surface to a bright finish the instrument must be taken apart, removing the fall, lock rail, knee swells, candle brackets, and all loose portions; smooth down with worn glasspaper, then apply a coat of spirit varnish; when this is dry, rub down by means of polish rubber charged with thin polish, and finish out with a little glaze in the rubber. Except on flat portions spiriting out is impracticable. To attempt to work the cases up with polish alone is not advised: the process is tedious, and constant working would disturb the under surface and eventually cause it to "check" and give a cobweb



Milk Sieve.

simply soldered to the body; the latter method is the quicker, but the former makes a more practical job, and renders the sieve much more durable. Assuming the adoption of the "beat-up" rim, wire the strip of metal, turn it to shape, and solder the seam. Now set off outwardly a small edge so that it will tightly fit in the creased edge of the body, pane it down, beat up in the usual way, and solder it all round on the inside. The gauze bottom, which is equal in diameter to ED (Fig. 1), is cut out and soldered to the body ou the outside of the edge previously mentioned. It can be obtained from a local ironmonger, and should coutain at least four hundred holes to the square inch. The smaller rim is now made in a similar manuer to the other rim, except that it is simply soldered to the sieve without previously beating it up. A loop (Fig. 3) of wire is plated with tin to form a hinge, and then riveted and soldered to the larger rim at the top of the seam. In conclusion, all utensils made of tin which come in contact with milk are better if resin is used as a flux for soldering.

Finish of American Organs. - There is a marked difference in the finishing of American organ cases made in the United States and those made in England. made in the United States and those made in England. American-made organs generally conformto one practice and are finished dull. The designers bear this in mind when drafting out designs, and the case makers are consequently less particular as regards the clean, level finish of the wood. Hence the dull finish does not reflect or show upall inequalities; on the contrary, if the cases are worked up bright the result is not always satisfactory. Organ cases intended for bright piano finish are less intricate in design and are cleaned up much better by cabinet makers. English made goods are generally veneered if intended for bright finish. Occasionally, however, they appearance. To handle American organ cases so that when finished bright they will not have a glarish, treacly appearance, much practice and tact are necessary. Instead of working them up bright by means of French polish, a pleasing finish that becomes brighter by each successive treatment is gained by constant cleaning with a mixture of equal parts of malt vinegar, linseed oil, and methylated spirit, or equal parts of linseed oil and turps may be used.

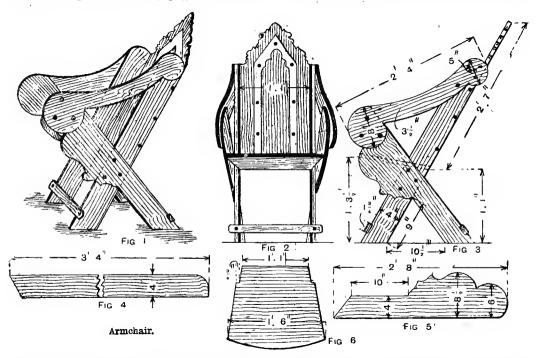
Powdering Gum Arabic .- Experiment shows that Powdering Gum Arabic.—Experiment shows that gum arabic retains a certain amount of moisture, which renders it tenacious and difficult to powder. If dried for some hours in a moderately warm oven, gum arabic will be found much easier to pulverise in the mortar. On the large scale it would be powdered in a disintegrator. As a rule, gum arabic is not powdered at all; it is readily soluble in cold water if left to steep for several hours. several hours.

Cleaning Beer Cask.—To clean the inside of a cask that has been used to contain beer, proceed as follows. Take out the head of the cask, first marking with a punch the end of a stave, and also the head opposite, so that it may be returned to the cask in exactly the same position as before. Clean the cask with cold water and a little soda and a coarse hard brush, and finish off with warm water and soda if thought desirable. If any smell remains, it may be necessary to take off the staves separately, and shave the inside of each, then replace them. The heads would also be taken out and served similarly. If any fungous growth exists, after the heads are in steam may be forced through the bunghole by means of a tube attached to a boiler; or the inside may be washed with a solution of sulphurous acid or hisulphite of lime, any excess being drained out after being allowed to lie for a time. Finish by rinsing out with water. Cleaning Beer Cask .- To clean the inside of a

Using Tissue Paper as Balloon Material.— Tissue paper cannot be rendered perfectly impervious to hydrogen, but it is possible to make such paper less pervious by dipping it in melted parafin wax, or by placing on the paper some wax and rubbing a hot iron over until the paper is well covered with the wax. As the wax renders the paper harder it may be necessary to remove some of the wax by placing a sheet of blotting paper on each side of the waxed paper, and running over it a hot iron. The tissue paper could also be treated with boiled linesed oil laid on sparingly. Balloons for hydrogen are usually made of a soft hut strong and closely woven silk treated with boiled oil.

Armchair.—Fig. 1 illustrates a comfortable chair that can easily be constructed by any amateur, as there is no devetailing, mortising, or tenoning. Fig. 2 is a front elevation and Fig. 3 a side elevation of the chair. All the stuff is ½ in. thick, and pitch-pine will be found very lasting, though red pine will do very well. Having cut out the different pieces, put the legs (Figs. 4 and 5) togsthera this requisite distances apart as shown in Fig. 2. Then fasten on the arms with screws, 1½ in. long, sunk in ½ in. so as to take a turned button-head dowel over the head. The edges of the back having heen planed to the bevel taken from the plan of the seat (Fig. 6), the back itself

trol over the character of the image obtained. The dishes used are upright tanks with grooves to hold the plates, six or nine of which can be inserted at a time, and a lid is supplied which keeps out air, and also protects the plates from the togging action of even red light. The developer found very successful is one made up according to the formula given with the Warwick plates, which for this particular method of development is diluted, when mixed for use, with its own bulk of water. The tanks should be filled right up to the brim, and the plates inserted and left for ten minutes or so, when progress can be examined. Similar tanks can be used for fixing, and much space and material is thereby saved. The negatives will be found to develop evenly and cleanly, and there is but little tendency to fog provided the developer is well diluted. In addition, good density is obtained; but should difficulty occur, it is well to have a dish of normal developer ready, into which the plate may be put for a minute or so before heing fixed, or it may be subsequently intensified. Tabloids make very suitable developers for this method, and should be powdered before being mixed. Pyro (with sodium sulphifte to prevent undue staining) is a favourite developer, but combined glycin or hydroquinone, and eikonogen or metol (the two latter alone have been found to give too thin negatives, while quinol is too harsh) will



is next secured to the front legs with 2-in. screws. Fillets, 2 in. deep and 1 in. thick, are screwed to the legs, and act partly as clamps to them. The seat is screwed to these and to the back with 2-in. screws. A bar, 13 in. by 3 in., is joggled over the front and back legs to keep them rigid, and the back is ornamented with a piece of 2-in. yellow pine cut to the pattern shown. With hair cushions for the back and seat the chair is complete.

Stand Method of Development for Photographic Snapshots,—Many amateurs, recognising that the average snapshot has a great tendency to under-exposure, may be glad to have details of a method of development which enables negatives to be saved that would otherwise be quite worthless. By its means some very fair prints from negatives exposed under most adverse circumstances have been obtained, such as, for instance, the embarkation of troops in a bilinding snowstorm, or in a thick November fog. The plates were extra rapid ones, the lens aperture was fill, the exposure one-ninetieth of a second, and development was complete in from half an hour to one hour. It is also a good method of developing negatives of the soot and whitewash order, such, for instance, as an instantaneous outdoor portrait on a slow plate with rather trying contrasts, for as the developer used is a weak one, there is far more con-

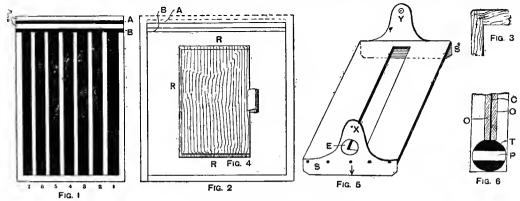
work very well. The fixing solution is one of sodium hyposulphite, 16 ez., to water 40 ez., or 2 pt., which preferably is distilled. To get the best results, the developer should also be mixed with distilled or boiled water.

Burning Wood Refuse.—The economic consumption of wood refuse is a problem apparently not yet satisfactorily solved. As a rule, the waste material is collected by a blow-piping system, with a fan and cyclone attachment, which delivers the material in the boiler room close to the furnace doors. Here, in conjunction with a certain proportion of coal, it is used in the ordinary way as a direct steam-raising fuel. But the conditions that are best adapted for coal combustion are not altogether satisfactory in the case of wood refuse. To burn well, a much stronger blast is needed for wood refuse than for coal; and, when the draught is increased, the light, half-consumed wood particles are discharged in a dangerous condition through the chimney. An attempt to get over this difficulty is made in Shepherd's patent wood-refuse furnace. Here in an independent butch about 4 ft. square, and covered in at the top, the shavings, etc., are hurned under conditions that prevent the escape of incompletely burned particles; while the heat and gases generated are brought away, and utilised in any manner required.

Changing Box for Photographic Plates.—Undountedly the best form of changing box is the bag changer. But a changing box that has seemed to give great satisfaction is described below; though it must be admitted, however, that it appears to be rather liable to cause fog. The two sides of the box are grooved in the manner shown (see Fig. 1), seven grooves \(\frac{1}{2}\)in. wide running vertically, and two grooves \(\frac{1}{2}\)in. wide running horizontally at the top. The back is like Fig. 2, and the front is similar except that the front will be the width of one groove higher than the back. An ordinary joint as shown in Fig. 3 will suffice for connecting up the framework, but must fit well to be light-tight. The hottom of the hox is a plain board. Two sliding lids to run in grooves A and B (of the form shown in Fig. \(\frac{1}{2}\), that is, with rebate R) are next made and inserted in the grooves; these sliding lids should run easily. The lid A runs from the frout into the top groove, and the lid E from the back into the lower groove; a rail must be fixed above B at the back in order to receive the tongue of A. These lids sliding in reverse directions can form an opening ahove either of the vertical grooves that carry plates. A piece will be required the full size of the top of the box covered with black velvet and fitted at the sides with thin brass plates S (Fig. 5); these plates grip the box tightly, and projections fitted at X and Y serve to grip the slide. On the side of each strip S is an arrow indicating the position for the opening by causing this to come in line with marks made on the sides of the box corresponding

suffice at first) must be very small, so as to give normal results. These can be obtained from a model maker's, or a pipe-light gas cock can be used if the nose is bent. For tees needed for the branches, glass is not available, nor is it particularly necessary. Zinc or copper tube, cut and soldered into tees, will do, and they in no way interfere with a view of the water movements. For the heat, a small spirit lamp under the boiler will do, or the heat, as small spirit lamp under the boiler will do, or the heat which comes from the chimney of a small paraffin lamp serves well. Powdered amber or fine sawdust of mahogany will make the water movements visible. Either of these materials must first he put into a bottle with water, and shaken up. After the bottle has stood an hour, it will be found that some of the dust is floating and some settled, but sufficient will be found to he suspended in the water. The water, without the floating material or sediment, is then poured into the apparatus, and the heat applied. It may be added that the model must be attached to a board by wires or clips, as it is not rigid enough to stand erect without support. A square of lattice may be used and the parts wired on. This makes easy any alteration or rearrangement that may prove desirable.

Fitting Third Pivot to Watch.—Below is described how to fit a new third pivot to a watch. If the turns are used, centre the pinion for drilling with a sharp-pointed chamfering tool held in the hand. Run the pinlon in the turns on this centre, and see



Changing Box for Photographic Plates.

with the centre of each vertical groove. A special form of dark slide is required, of the solid form, which is fitted with a tap-like arrangement T (Fig. 6) in the bottom rall; when this tap is turned a free passage P is permitted into the slide. A section of this fitting is shown in Fig. 6. In filling the box, the plates 0 0 (Fig. 6) are laid back to hack with an opaque black card C between, and dropped into the six grooves (twelve plates in all). The end groove No. 1 is left vacant in order to receive (after exposure) the two plates already in the slide. The lids of the box are then re-fixed and the box is ready for use. When the two plates in the slide have been exposed, the bottom of the slide is placed between X and Y, the end of T going through E. Now by bringing the top lid over groove 1, and revolving T, the plates fall into the groove. Moving the arrow to 2 and inverting the box (of course, drawing out and in the two faise lids A and B) allows a fresh pair of plates to fall into the slide; then T is again turned, A and B are closed, the top lid is pushed flush, the bolts are loosened, and the slide is removed. In the hands of a careful operator this device has given satisfaction.

faction.

Model of Hot-water Apparatus.—A model of a hot-water apparatus for domestic supply must consist of a hoiler, reservoir (cylinder or tank), cold cistern, piping, and cocks. For the hoiler, procure a low glass bottle or jar, about 2½ in., with a large neck. Cork the neck soundly, and hore two holes through the cork for the pipes. For the cylinder or tank, a short lamp chimney will do, corked soundly at each end, the corks being bored for the pipes. The cold cistern need not be of glass; a zinc or tin vessel will do, with a short piece of tube soldered into it at the bottom. The pipes are of :in. glass tube, which can be purchased at about a halfpenny per foot. It can be broken clean at any point by marking it round with a smooth file, and can be bent in any gas flame (a hlue flame is cleanest). The joints, where two pipes come together, can be made with short pieces of elastic rubber tube of a smaller size, and stretched on. The cocks (two will

whether it is true. If not, draw it as required. A short, strong, perfectly hard, and untempered drill is used. It is inserted in a central hole in a brass runner. The pinion is revolved by a bow, and the runner holding the drill is pressed against it with the fingers, and slightly revolved backwards and forwards. Turps is used to lubricate. The moment the drill become burnished. If the pinion is too hard to drill, heat it to a pale blue, and remove the blue with spirit of salt, a momentary dip only, and wash well in water. Drill to a depth of at least a pivot and a half. Harden and temper a piece of steel wire, and file up in the pin-vice to a tight fit in the hole. Let it be smooth and burnished, and the hole clean. Tap it in with a hammer until it is home. Then centre in the turns, drawing the centre with a file until true. Turn the pivot on it. Smooth it with oilstone dust and oil mixed to a thin paste, and used on a flat soft steel polisher as a file, the pivot revolving and resting on a brass polishing hed, which is a brass runner suitably filed. When smooth, clean off, re-file the polisher clean, and polish with red-stuff and oil used in the same way. Round up and hurnish the pivot end in a "lantern runner."

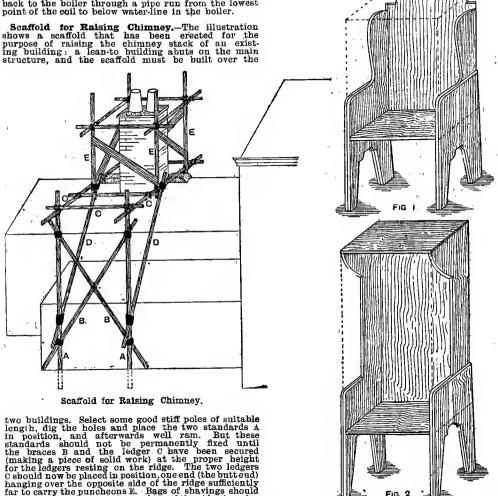
Cements used by Dentists.—The cement princi-

Cements used by Dentists.—The cement principally used by dentists is an oxyphosphate of zinc. The material consists of a llquid containing phosphoric acid and phosphate of zinc, and a powder consisting of oxide of zinc. When the two are mixed to a paste they set rapidly and form the oxyphosphate. Zinc oxychloride is another cement; it is formed by mixing oxide of zinc with a strong solution of chloride of zinc. Feichtinger recommends that 3 parts of zinc oxide be added to 1 part of powdered glass, and this mixed with 50 parts of a solution of zinc chioride of p. gr. 1.5 or 16; then add 1 part of borax dissolved in the least possible quantity of water. Zinc oxysulphate is a similar cement formed by calcining 1 part of sulphate and mixing it with 2 or 3 parts of oxide of zinc. The mass is mixed to a paste with water previous to using.

Heating Water by Steam.—Exhaust steam is the most economical heater for water. The exhaust steam would have to be blown through a tuhular heater in the tank, but in order to keep the heater in effective condition the steam must first pass through a separator which will free the steam from oil. If live steam is used, then the most economical plan, in cost and in time, is to blow the steam direct into the tank; but this blowing of steam into the tank is accompanied by an unbearable noise if the tank is situated where noise will cause a nuisance. An appliance called a silencer may be fitted to the tank; but experience has shown that to obtain silence when free steam is blowing into cool water is a difficult matter. The noiseless method of heating by live steam is to let the steam circulate through a coil, the condensed water flowing back to the boiler through a pipe run from the lowest point of the coil to below water-line in the boiler.

the sitter from draughts; but Fig. 2 is quite an old man's chair, the sitter being sheltered from the sun and wind and from slight showers also. It may be sawn from a box 3ft. long. To make, such chairs look well they should be painted, and some persons will find them more comfortable if the back legs are kept from 1 in. to 2 in. shorter than the front ones, so as to give a slight inclination to the seat and back. The original form of the boxes is indicated by the dotted lines.

Self-heating Soldering-bit.—Soldering-bits heated by benzoline or spirit may be made with a small barrel-shaped reservoir, and this, in addition to holding the



Garden Chairs made from Tea-chests.

two buildings. Select some good stiff poles of suitable length, dig the holes and place the two standards A in position, and afterwards well ram. But these standards should not be permanently fixed until the braces B and the ledger C have been secured (making a piece of solid work) at the proper height for the ledgers resting on the ridge. The two ledgers C should now be placed in position, one end (the buttend) hanging over the opposite side of the ridge sufficiently far to carry the puncheons E. Bags of shavings should be placed between the ledger poles and the ridge in order to prevent fracture of slates, etc. The braces D (for supporting the long ledgers) are next fixed, the short ledgers are tied to the long ones, and the puncheons E secured at the bottom to the long ledgers and at the top to the short ones. Scaffold boards for bracing are nailed to the puncheons, and boards are laid for the bricklayers. Each scaffold is reached by a ladder.

Garden Chairs made from Tea-chests.—Fig. 1 shows a garden chair made from an East India tea box, 2 ft. Iong and 18 in. wide and deep, the only tools being saw and knife. Better legs might doubtless be made with 2 in. or 2½ in. scantling, if such should come readily to hand; but those shown are waste board from the box tiself, and consist of two thicknesses nailed together between the seat and the ground. The box (lid included) will yield enough spare wood, not only for the legs, but for strengthening wherever this may be required. This chair is one which will pretty well screen

spirit, is used as the soldering-iron handle. One end of the reservoir is fitted with a filling cap, and from the opposite end protrudes the tube carrying the burner. To the tube end of the reservoir an iron clip is attached, and this secures an iron bar which stands out over the burner head. At the end of this bar the copper bit is attached and held either vertically or horizontally in the flame the flame

Polishing Watch Jewel Holes.—By the usual method, stones for watch jewel holes are ground and polished with diamond dust on iron and copper mills or. aps. The interior of a hole is polished by centreing the jewel hole in a lathe by means of shellac, and introducing a thin copper wire, into which diamond dust has been hammered. A high speed is necessary.

Making Gelatine from Ham Skins.—In making gelatine from ham skins, these should be boiled in a digester for several hours under a few pounds pressure until the material is thoroughly softened and the gelatine is practically all in the water; the solution may then be drained from the refuse, and in order to clarify it for making clear gelatine the solution should be strained through a cloth and theu allowed to become cold, when the fat can be cut away from the surface. The jelly should be heated gantly until just fluid, then the whites of one or two eggs should be stirred well in, and the solution heated to boiling. The white of egg coagulates and carries with it all the finely divided suspended matter, provided the temperature was not more than 100° F. when the white of egg was stirred in. The material may now be filtered through a fiannel bag kept in a warm place. The solution should be run into oblong wooden moulds, and when set the jelly should be turned out by taking away the sides of the moulds. The slab of jelly may be cut with a wirs into cakes of about \(\frac{1}{2}\) in. to \(\frac{1}{2}\) in in thickness, and these should be jlaced on cord nets in a clean warm room to dry. The difficulty in drying is to get the cakes hard before any germs grow on them: this can only be managed with cleanliness and as little dust as possible. When the cakes are dry, they should be wetted on the outside, brushed well with a small brush, and again dried.

Fitting Revolving Oilstone.—The illustrations show a wooden stand in which to mount a revolving oilstone which is $2\frac{1}{2}$ in. in diameter and $1\frac{1}{2}$ in. thick. It will first be necessary to make a spindle as Fig. 1. This may be forged from a piece of $\frac{3}{2}$ -in. round iron worked down to $\frac{3}{2}$ in. at A, where it passes through the stone, $\frac{3}{2}$ in. in diameter at B for the bearings, and with a solid collar worked at C. A wooden or bone handle is fitted at one end D, and a nut is used at E to hold the stone on the spindle. The stand may be of $\frac{3}{2}$ -in. hard-

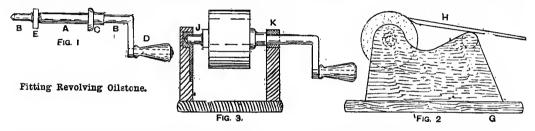
the actual bulk of a square tapering log is as follows (assuming, of course, the squars to be perfect and the taper uniform). Multiply the width of the large end by. the width of the small end; add to this the area of both ends and multiply by one-third of the length. Take, as example, a log $12\,\mathrm{ft}$. long, $2\,\mathrm{ft}$. square at large end, and $1\,\mathrm{ft}$, square at small end. Width of ends multiplied together $2\times 1=2\,\mathrm{ft}$. Area of large end $2\times 2=$ $4\,\mathrm{ft}$. Area of small end $1\times 1=$ $1\,\mathrm{ft}$.

These added 7 Multiplied by $\frac{1}{2}$ length 4

Dealing with the same log by recognised method Mean girth equals 6 ft. Quarter of this $6 \div 4 = 1\frac{1}{2}$ ft. This squared $1\frac{1}{2} \times 1\frac{1}{2} = 2\frac{1}{4}$ ft. Multiplied by length ... 12 ft.

Recognised bulk 27 cube ft.

showing an allowance for taper of just 1 cub. ft. I showing an allowance for taper of just 1 cub. ft. For round logs it is only necessary to remember additionally that the ratio of the circle to the square which contains it is '3854: 1; that is, to find the area of a circle, first find the area of the square which just contains it, and multiply by '3854. I might point out to those readers who are not fond of decimals that the fraction 14 will equal '7857, so that if the area of the circumscribing square is multiplied by 11 and divided by 14, it will give an error of only 3 in 10,000. Assume a round log to be 15 ft. long, 3 ft. across the large end and 2 ft. across the small end. Find by the above method the volume of the square log which will just enclose it; then multiply by 11, and divide by 14.



wood, the two side pieces being shaped as at F (Fig. 2), and the base as G (Fig. 2). A plane iron is shown in position for sharpening at H, and for supporting the back end of this a t-in. diameter rod I may be dowelled between the supports. The side pieces may be glued and screwed to the base, and a couple of screw holes should be bored through the hottom for securing to the bench. Fig. 3 is a cross section through the spindle, showing the bearings, a brass socket being used at J, and a simple bearing made out of a couple of the industry lates secured to the side with screws at K.

Colouring Illumination Lamps.—To colour a number of white illumination lamps in different tints, the lamps should be first thoroughly cleansed from grease. For a red colour, obtain some dry crimson lake and turpentine varnish; grind up the lake to a paste with a little of the varnish, thinning it with more of the varnish to a working condition. The lamps should be coloured inside, using a flat fitch boush. In working, turn the lamps about so that the colour may evenly cover the whole surface. When thoroughly dry they are ready for use. For a yellow colour, use gamboge; for blue, use Prussian blue; and for green, mix together Prussian blue and gamboge. Prussian blue and gamboge.

Log Timber Measurement.—The recognised method of measuring log timber is to take a quarter of the girth, at the middle of the log, in feet, square it, and multiply by the length, also in feet. It is acknowledged that, unless the log is parallel and square, this rule does not give the actual bulk, but something less, and it is wisely argued that this is as it should be, in view of the waste that usually takes place when converting round or tapering logs. However, beyond knowing that certain allowance is being made, ignorance frequently prevails amongst users of this rule as to the amount of discrepancy from the actual cubic contents. This is, perhaps, due to a notion that to obtain the actual figures would require a considerable amount of skill and patience. The following is an attempt to point out as simply and as profitably as possible the fallacy of this idea. A very simple rule for discovering Log Timber Measurement.—The recognised method

6 ft., 9 ft., 4 ft. Widths of ends multiplied $3 \times 2 =$ Area of large and $3 \times 3 =$ Area of small end $2 \times 2 =$ 19 ft. Added Multiplied by \(\frac{1}{3}\) length 5 95 cube ft. Actual bulk of square log 14 1045

Quarter of mean

Same log by recognised method. girth will be just under 2 ft. This squared $2 \times 2 =$ Multiplied by length 15

Actual bulk of round log

Recognised bulk ... 60 cube ft.

Showing an allowance for roundness and taper of over 14 cub. ft. For a round parallel log, find bulk of square log which just contains it, multiply by 11 and divide by 14, as before. Take a round log 2½ ft. in diameter, and 14, as before. 20ft. long.

Bulk of square $\log 20 \times 21 \times 21 = 125$ cube ft.

14)1375 9814 cube ft.

7414 cube ft.

Bulk of round log

By recognised method. Quarter of mean girth will be just under 2ft. This squared $2 \times 2 = 4$ ft. Multiplied by length 20

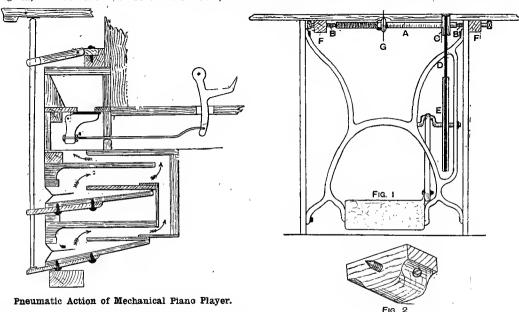
80 cubeft. Recognised bulk ...

Showing an allowance for roundness of over 18 cub. ft.

Treating Raw Gutta-percha.—There are two methods of treating raw gutta-percha for removal of the impurities. The gutta may be softened in water at a temperature of about 50° C., and is then rolled out into a band by iron rollers, the top roller being loose so that any stones or hard bodies raise it and pass through. The stones, etc., are then picked out and the gutta strips folded into loose blocks, which are treated in a cylinder, and on emerging are cut into shavings by two revolving wheels. Or the gutta is placed in boiling water and then brought between two cylinders; the inner one revolves, and, being covered with sharp teeth, tears the gutta to shreds, which are carried away by water flowing between the cylinders. The shreds are softened in hot water, and the mass is kneaded in a machine in which are two or more revolving rollers covered with blunt spikes. The ordinary gutta-percha of commerce would require only to be softened in hot water and rolled into ribbon hetween iron rollers to fit it for the manufacture of golf balls.

Pneumatic Action of Mechanical Piano Player.— The main principle of the action of one kind of mechanical piano players is illustrated in the accompanying diagram, in which two small bellows are shown; some or until it slightly thickens, and is then allowed to cool down to 140°C.: 2 per cent. of finely ground litharge is then added and the whole thoroughly agitated. It is then allowed to cool to about 95°C., and is thinned down with American turpentine in the usual manner. The resulting varnish dries in about six or eight hours. Resin, manilla, or dammar gums may be added to the varnish, the quantity being from 50 per cent. to 75 per cent.; this renders the varnish hard and elastic, and it dries in eight or ten hours with a hard transparent gloss. Wood-oil varnishes are more resistive to atmospheric influences when worked up with pigments; these varnishes are also useful in the preparation of enamels, especially when incorporated with zinc white. In the preparation of lacquers wood oil is also very useful, as it possesses the remarkable property of being soluble in amyl alcohol, which renders the oil valuable in the lacquer industry. Many attempts have been made to deodorise wood oil, but up to the present without success; the odoriferous principles are the result of oxidation.

Circular saw Attachment to Sewing-machine Stand.—The illustrations suggest a method of fixing a small circular saw and spindle to a strong sewing-



instruments have one bellows only. It will be noted that the plunger is lifted up by strips secured to the bottom of the bellows; in some cases wire connections are made instead of using round or square rod plungers. The valve is released by a wire rod; when the aperture is thereby opened the bellows close np, thus giving the necessary impact. The operating finger is shown rather short; in practice, the plunger strikes nearer the tail end.

Chinese Wood Oil.—During the last few years wood oil, also known as tree oil, oil varnish, and tung oil, has been introduced as a substitute for linseed oil, principally in the manufacture of oilcloth, varnishes, paints, and lacquers. Owing to the high price of linseed oil, many of the leading experts have investigated the properties of wood oil, the result of these observations varying considerably. Wood oil requires extreme care when used in the manufacture of oil varnishes, as it gelatinises at a temperature of 180° C, and is then useless for manufacturing purposes. Another fault in wood oil is that when used alone or with linseed oil it assumes a whitish cast, this being particularly noticeable when exposed to atmospheric influences; also in a damp atmosphere it loses its adhesion somewhat, but eventually hardens again when exposed to warm air or sunlight. To make Chinese wood oil a commercial article for varnish making requires a special treatment to prevent it peeling. The method is as follows. The oil is first heated for two hours at 170° C, and then placed aside to repose for fifty hours, when the clear top portion is ladled off; this is known as clarified oil. The clarified oil is then heated to 180° C, for about one hour

Circular-saw Attachment to Sewing-machine Stand.

machine stand, so that the saw may be driven by a treadle and wheel. Fig. 1 shows a front sectional view of the stand as fitted up with the spindle A (carrying saw, G) working on centres B and pulley C, connected by the band D to the flywheel E. The steel screws with conical points are shown turned into hardwood blocks F; these blocks are each secured to the under side of the table with two stout screws. An enlarged view of one of the blocks is shown at Fig. 2. The pulley C may be of hard wood about 3 in. in diameter.

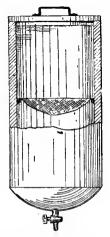
Finding Running Feet in Square Yard of Boards.—The number of running feet to form a square yard of flooring boards, etc., is readily obtainable by the following method. Divide 108 by the width in inches of the single board, and the result is the length required in feet. Example.—What length of 5-in. floorhoards is required to form a square yard? The answer is $2l\frac{\pi}{4}$ ft. If the boards were 7 in. in hreadth, then $15\frac{\pi}{4}$ ft. would be required. The general rule is arrived at as follows: Number of square inches in $1\text{sq. yd. is }12\times12\times9$. The area of 1-ft. length of board having any width W is $12\times \text{W. sq. in.}$; hence the length of feet required is $12\times12\times9+12\times9$. The No difficulty need be experienced even if the measurement of the boards be other than complete inches. Example.—How many $4\frac{\pi}{4}$ -in. boards, would be required? Reduce both to halves; then $216\div9$ gives the required result—namely, $2\frac{\pi}{4}$ ft.

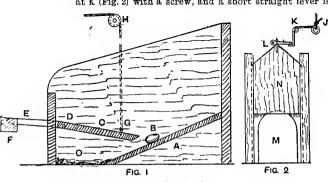
Cleaning Windows.—Many different substances are put into the water used by window cleaners. The most powerful is hydrofluoric acid. This acid will dissolve the glass itself, and it removes grease, soot, etc., almost instantly. Much care is required in handling this acid. The best materials for ordinary purposes are dilute solutious of caustic soda or caustic potash. These may be obtained in the commercial forms from a dealer in chemicals, and may be employed in the proportion of 1 part of alkali to 20 parts of water. Another form of window cleaner may be made by slaking a little lime in water and adding to it carbonate of soda; or lastly, washing soda may be used. When using any of these substances the windows should be washed thoroughly with clean water before being dried, as they all have a tendency to act on the glass and render it dull.

Clarifying Fat.—For clarifying fats used for frying, a tall jacketed copper cylinder, through which steam can be passed, will be necessary. If the fat is merely turbid from finely divided burnt particles, it will simply be necessary to filter it; but should further purification be required, then the means for doing this would have to be considered. Fat for culluary purposes should not be treated with chemicals; all that is necessary is to add about loz. of fuller's-sarth for each pound of the melted fat, stir it well in, and then allow it to

with a piece of soft rag, and then polished with another piece of rag. A pad made with a bottle cork inside several folds of rag is useful when silvering broad surfaces. The double salt of silver and soda hyposulphite paste above mentioned may be dissolved in boiling water, and used in a liquid state to silver bunches of brass or copper trinkets by swilling and shaking them in the solution until they are white enough. They should then be swilled in clean hot water and dried by friction in hot bran or hot sawdust. Silvering pastes are sometimes made with salts of quicksilver or mercury in them, and these are said to be more certain in action than other pastes. But the white coat thus obtained soon turns black when exposed to air, and the mercury renders brass brittle and rotten.

Trap Nest for Fowls.—Fig. 1 shows a section of a trap nest for laying hens. The bottom of this box consists of a slope piecs A at the back, to which the nest egg B is secured, and a movable piece C working on pivots D fixed at the ends to work in holes bored through the ends of the nest hox. A lever E is secured at one end of C, and to the other end is attached a balance weight F to lift C to the position shown. If desired, a spring may be used instead of the weight. A cord is attached to the end of C at G, and this, after passing through a hole in the end of the box, is brought over the pulley H, and taken to another pulley over J (Fig. 2). A bell crank lever, made out of a piece of wire, is secured at K (Fig. 2) with a screw, and a short straight lever is





Trap Nest for Fowls.

Apparatus for Clarifying Fat.

subside in the jacketed cylinder; but before this is done the filtration should be tried. An efficient filter may be made from a hoop of metal fitting tightly within the cylinder, which is suitably supported and provided with a lid, and resting on three supports soldered on the cylinder at about half its beight. The hoop should be loosely covered with fiannel, which will hang down in the centre. The melted fat should be poured on the fiannel, and will pass through it into the lower part of the cylinder, from which it may be drawn by a cock as shown in the sketch. An inlet pipe may be inserted near the top, if desired.

Substitutes for Silver-plating.—All paints and solutions made to serve as substitutes for silver-plating have a chemical action on the metal to be coated, dissolving a portion thereof and depositing an equivalent of silver in substitution. Deposition, therefore, ceases when the metal has been coated with a very slight film of silver, and such preparations are, therefore, only imperfect substitutes for silver-plating. They can only be usefully employed where a silvered appearance is desired apart from considerations of wear and tear, as in the case of articles protected by glass or lacquer. The active ingredient in silvering pastes is silver chloride; this is prepared by adding a solution of commou salt to a solution of silver nitrate in distilled water until all the silver has been precipitated, then pouring off all excess solution from the white curdy silver chloride. This white paste may then be mixed with an equal bulk of bi-tartrate of potash; or with twice its bulk of powdered alum added to 8 parts each of common salt and cream of tartar; or with an equal bulk of prepared chalk added to 3 parts of pearlash and 1 parts of common salt; or the silver chloride paste may be mixed with six times its bulk of soda hyposulphite. The wet silvering paste thus prepared must be rubbed on the previously cleaned metal

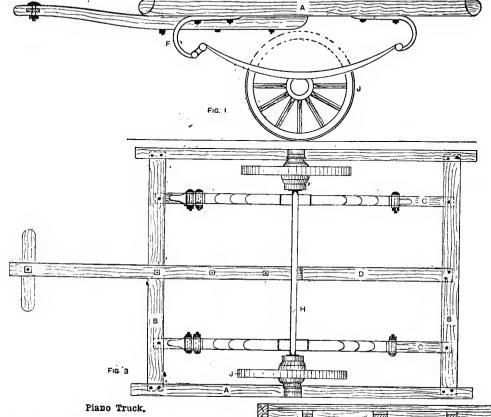
secured at L with another screw. The entrance to the nest box M is fitted with a sliding door N, which is bung on the lever L by means of a book. When the hen enters the nest, the weight on C pulls the cord and lifts the lever at J, which releases the trigger and allows the door to drop. When the hen leaves the nest, C (Fig. 1) rises, and the egg rolls into the cavity 0, where some chaff is placed to prevent the eggs breaking. This arrangement is also useful to prevent hens eating the eggs. The nest box is placed in a pen which can be entered only through the door M (Fig. 2).

Recovering Gold from Pure Gold-leaf.—It is possible to recover gold from good gold-leaf. To do this, the gold-leaf should be mixed with gum water and dried, then placed in a crucible and heated till no further smoke arises. Borax should then be added, and the crucible brought to a white heat. On breaking the crucible, the gold will be found as a button. To obtain pure gold, the silver and copper would have to be removed by solution in aqua regia, and the pure gold would be precipitated from this solution by boiling with ferrous sulphate. The finely divided gold could then be fused as above described.

Dyeing Leather Black.—Leather is dyed either by rubbing on the dyes or by immersion, but the former method will serve most purposes. Make two solutions, one by boiling 41b. of logwood chips with lgal. of water and straining; then add to this a little carbonate of soda. The other solution is made by dissolving 8 oz. of sulphate of iron (copperas) and 1 oz. of sulphate of ocopper in 1 gal. of water. Having both solutions warm, brush the logwood solution well into the leather, and after about a quarter of an hour follow with the iron solution; allow the leather to dry partly, and, if the black is not continuous, brush again with both solutions. Rub up a little soap with water and add a little egg yolk; put this on the leather, and rub well in. Dry the leather slowly and smooth piece of wood.

Piano Truok.—The framswork of a piano truck should be of thoroughly dry English ash. The outer bars $\Lambda(\text{Figs. }1,2,\text{ and }3)$ are 5ft. 6 in. long by 3 in. deep and 2 in. thick, and are tenoned together with the cross-bars B (Fig. 3), which are 3in. wide by 2 in. thick, the frame being 5ft. long by 4ft wide outside. The two summers Care 2 in. square, and the centrs one D is $2\frac{1}{2}$ in. wide by 2 in. deep. When put together for good the tenons and mortises should have a good coat of white-lead mixed with raw linseed oil. The boards on top of the frame are 1 in. thick, and bring it level with the side pieces. The handle is $2\frac{1}{2}$ in. square under the frame, and tapers slightly to the front, the

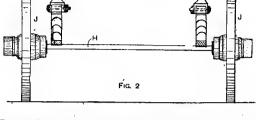
not allow them to remain stationary in the fire, but move them backwards and forwards, working from the centre of the plate to one end; serve the other end in a similiar manner. When tempered, and whilst hot, hold the plate over a saddle tool or in the jaw of the vice and give it a sufficient number of blows to bring it to the right compass. Having finished the hack plate, let it lie on the fitting plate edgeways; make the next plate red hot, place it in its position on the back plate, and whilst a helper is gripping the two plates together at one end smartly pinch them together with the spring tongs; then cool out in water, re-heat, and temper as before.



cross handle being I ft. 4 in. long by 2 in. wide, and I in. thick. The front scroll irons F (Fig. 1) are 7½ in. deep to the centre of the bolt, the hind ones G (Figs. 1 and 2) being 6 in. deep to the centre of the bolt. The springs are 3 ft. 2 in. to the centres of the eyes, the compass over the last plate from the centre of the eyes being 6 in., the number of 2 in. steel plates five, No. 1 thick for four plates, and No. 2 for the back plate. The grease axle H (Figs. 2 and 3) is I in. square, with right- and left-hand threads and nuts. The wheels J (Figs. 1, 2, and 3) are I ft. 9½ in. high when tyred, the diameter of the stock being 5½ in., the length 7 in., with twelve 1½-in. spokes. The height from the ground to the bottom of the framing is 2 ft.

framing is 2 ft.

Carriage Springs.—Here are instructions on setting and tempering springs for carriages. First it is necessary to decide what the compass in the back plate will measure when the spring is finished; from this measurement deduct in. for each plate with which the spring is made. This will give the exact compass required in the back plate before the other plates are fitted, and for a guide, mark two lines on the fitting plate at the distance required. Now make the back plate red-hot from end to end, grasp one end with the spring tongs, place the other end on the anvil, and gently press it in the middle until it assumes the depth and shape desired; this operation should be done smartly, so that the plate is still red hot when plunged into the water to cool out. When cold, re-heat the plate to temper it. To ascertain its right temper, rub along it a piece of wood till the wood flares. When letting the plates down, do



G

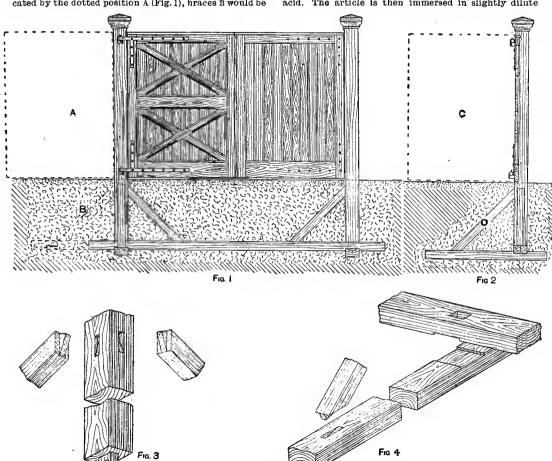
Repeat the process with each succeeding plate until the spring is finished. When fitting the plates together, there should be a space between each pair of plates at the centre of the spring whilst the ends are touching.

Paste Blacking for Boots.—For paste blacking for boots, mix well together 2lb. of ivory black, 2lb. of treade, and \$\frac{1}{2}\text{lb. of sweet oil, then add \$\frac{1}{2}\text{lb. of oil of vitriol and sufficient beer or vinegar to make I gallon. Another recipe: Melt \$0z\$. of beeswax in an earthen pipkin and stir into it 20z. of ivery black, 10z. of Prussian blue ground in oil, 10z. of oil of turpentine, and \$\frac{1}{2}\text{oz. of copal varnish. Make into balls, apply with a brush, and polish, with soft rag.

Fiving Heavy Gateposts.—The drawings show a pair of framed and braced gates each 6ft, wide by 8ft, high, the framework being 2½ in, thick, hung to pitchpine posts 9 in, by 9 in. All the support for the posts 1e provided below the surface of the ground as shown at Figs. 1 and 2. A mann sill or sole piece is provided and two pieces about 9 in. by 5 in., these and the main sole pieces about 9 in. by 5 in., these and the main sole pieces and are kept in position by braces about 5 in. by 5 in. in section. These braces would have tenons fitting into mortises in the sole piece and post, details being shown at Figs. 3 and 4. It will be seen that the posts are only braced in the two directions of principal leverage when, as in a great many cases, the gates work through an angle of 90° only: in other cases, where the gates open through an angle of 180° as indicated by the dotted position A (Fig. 1), braces B would be

applied to the tin by means of a camel hair brush, or the tinwork may be dipped into the lacquer. A uniform even finish is obtained by placing the tin, immediately after applying the lacquer, in an oven having a temperature of about 150° F.

Retinning Cast-iron Utensils.—The only reliable method of re-tinning old cast-iron ware is entirely to remove the old tin by filing, scouring, or machining, and then treating the article in the same way as that adopted for new goods. New cast-iron ware has the surface first prepared for tinning by being rendered smooth by one of the methods mentioned above; the article is then heated gradually to redness, and then allowed to cool. An alternative method to heating is to pickle the article for a short time in warm sulphuric acid. The article is then immersed in slightly dilute



Fixing Heavy Gateposts.

necessary, and the sole piece should also be longer as indicated by dotted lines. As a rule, braces would be quite unnecessary on the outside of the posts, because when the gate is open at 90°, as dotted at C (Fig. 2), the great pressure is in the direction of the brace D. The cole piece should rest on a bed of concrete about 6 in. thick, and by far the best results will be obtained by filling in the excavation made for sole pieces, etc., with concrete. It is a good plan to tar the timber work that is embedded, but if that method is adopted it is essential that the timber be thoroughly well seasoned, or it will decay all the quicker.

Lacquering Tin Green.—A green lacquer for tin may be prepared in the following manner. First discolve 2 oz, of orange shellac in 1 pt. of nethylated spirit by frequent agitation. Then add sufficient aniline green (soluble in spirit) until the desired depth of colour is obtained. Strain before using. The lacquer can be

hydrochloric acid and allowed to pickle for about twentyfour hours, and is then again pickled for a short time
in chloride of zinc. The article is then ready for tinning
by immersion in the usual way, a pad of tow or wool, on
which is sprinkled sal-ammoniac, being used to wipe out
the superfluous metal. Any untilned patches can be
remedied by warming the article to the melting point of
tin, and rubbing a little grain tin over the untinned
part with a lump of sal-ammoniac until the tin adheres;
then wipe it out smooth with a pad as before.

Heat-resisting Brown Paint.—For a heat-resisting paint of a dark brown or chocolate colour, to be used on a tin-plate lamp, mix 11b. of drop black ground in turpentine with ½ lb. of Indian red paste paint. Thin down to working consistency with 2 parts of turpentine and 1 part of japan gold-size. This paint will dry with a dull surface, and will not be affected by the heat from the lamp.

Regulating Louvre Boards for Drying Sheds.—Figs. 1 to 4 show an opening provided with regulating louvre boards suitable for a drying shed or similar premises. Frames with splayed sills, as shown, would be made and fixed. The louvres would next he fitted to lengths, and the edges splayed and fitted together, as shown at Fig. 2. From 30° to 45° will be a suitable angle for the splayed edges. At each end they would be connected to the frame by centre pins and plates, the centre pins being fixed to the jambs of the frame, and the plates to the ends of the boards, as shown at Fig. 5. By this means each board can be placed in position. To open and close and regulate the boards, a fillet 1½ in. by 2in. should be prepared, and hiuged to the upper inside edge of each board at one end, as indicated at A (Fig. 3). By pushing the strip up or pulling it down, the louvre boards can be opened or closed as required. To keep the fillet in position, one of the several forms of stays can be made to suit the purpose: or should the

51b. of light, middle, or deep shade zinc green, ground in varnish, and thin down to a uniform consistency with 2 pt. of crystal paper varnish, 4 pt. of pale copal or carriage varnish, 1 pt. of pale gold-size, and ½ pt. of American turpentine. This enamel will in about six hours dry hard, with a hard brilliant gloss, and is admirably suitable for interior decoration. Green enamel for exterior work should be mixed as follows: Mix together zinc green ground in best copal varnish 51b., with finest carriage varnish 5 pt., hody varnish 1 pt., pale gold-size ½ pt., turpentine ½ pt. The varnishes employed for the outside enamels should be of the finest quality, should possess good body and durability, and should be prequiring enamels for outside use: Best copal. For the interior enamels cheaper varnishes that are suitable for preparing enamels for outside use: Best copal. For the interior enamels cheaper varnishes may be used, as dammar, maple, French oil varnish, crystal paper, and pale oak, which are used in variable proportions with those first named. The undercoats to receive the enamels should be prepared with a flatted spirit colour, or colour ground in turpentine, adding a small quantity of pale gold-size or raw oil to bind it, the proportions being about 1 to 4. Two coats are generally sufficient, the work being well rubbed down and dusted after each coat to give it a solid and an even foundation upon which to apply the subsequent coats of fig 5 Fig.) Fig. 2 Fig. 4 Fig. 3

Regulating Louvre Boards for Drying Sheds.

louvre boards be out of reach, an iron rod could be fixed to the fillet, or the boards could be opened and closed by means of two cords, one cord being fixed to the bottom of the fillet, and the other cord to the top. The cords are worked over a pulley, as indicated at

Permanent Green Enamel.—The following formulæ for the preparation of green enamels have been found to give very satisfactory results with respect to permanency. Green enamels should be based on the zinc greens, or what are generally known in the trade as permanent or royal greeus. These greens (unlike the Brunswick and chrome greens) endure exposure to light and air, and are not affected by exposure to sulphuretted hydrogen. They thus possess a decided advantage over other greens, which tend to turn black. Zinc greens may also be safely mixed with all other colours. These greens are useful for painting Venetian blinds, window asshes, and any work that is much exposed to the sun's rays. In combination with suitable varnishes, zinc greens may be converted into very durable enamels, suitable for both interior and exterior decoration. The following are practical recipes for the preparation of enamels which have been found after a long experience to be unsurpassed for permanence, hardness, and lustre. Get

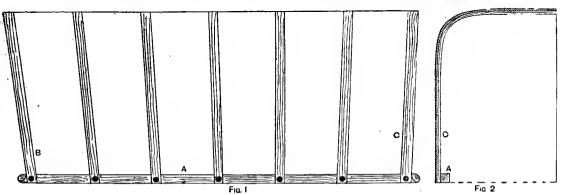
enamel, which will have an even and brilllant finish when completed. In all cases enamels should be applied in a warm temperature free from dust.

Faulty Barometer.—The wheel barometer is a syphon barometer, and if the mercury has collected at the bottom and refuses to rise, it is evident that a volume of air has entered the tube. This air must be ejected, and a true vacuum obtained in the tube above the mercury before the instrument will do its work. First remove the various parts carefully, then examine the tube. If it is sound and good, retill it with mercury clarified by dilute nitric acid. Boll the mercury and heat the tube by degrees over a spirit flame. Pour in a little of the mercury and boil it for some time. Theu allow it to cool, and add a further quantity of mercury, previously warmed, This again must be boiled, and the action repeated until the tube is quite full. In this manner the moisture and air which adhere to the sides of the tube pass off with the mercural vapour. A barometer tube is free from air and moisture if, when it is inclined, the mercury strikes against the top of the tube with a sharp metallic sound. When air or moisture is present the sound is deadened. In rearranging the weight and float over the pulley, remember that the weight is somewhat lighter than the float. Faulty Barometer.-The wheel barometer is a syphon float.

Setting Out Van Tilt.—As a help in setting out, Fig. 1 shows the side elevation of the framework of a van tilt 8 ft. long, 5 ft. wide, by 3 ft. 7 in. deep, and Fig. 2 a half-section of the tilt close-boarded on the outside. To make the tilt, two pieces of English ash A (Figs. 1 and 2), 8 ft. 4 in. long, 3 in. wide, by 2 in. deep, should be planned up square and true in line, and fixed on the van. Let in the front hoopstick B (Fig. 1), giving it a sail forward of 6 in., as shown, and keeping it in 2 in. from the front of the rave; then put in the hind hoopstick C (Figs. 1 and 2), giving it a sail backward of 1 ½ in. Having fixed both hoopsticks into the rave level with the outside, as shown in Fig. 2, set out an equal division at top and bottom, cramping the hoopsticks on to the edge of the rave at the same height as the front and hind hoopsticks. Fix a long straightedge on the top of the front and hind hoopsticks; it will then be easier to set the hoopsticks out true. A helper will also be necessary to tighten up the cramps used to keep the hoopsticks in place. When they are all in position, with a striking awl mark each side of the hoopsticks, then the raves, numbering them as the work is proceeded with. When this is done, take off all the hoopsticks, then the raves, and let the hoopsticks in with a cramp on each one, as the top and round the corners to get the boards on tight and level. Now fix the hoopsticks in with a 14-in. No. 14 screw at each side. For covering the tilt use \{\frac{1}{2}\text{ in. yellow}

ing the eyeglass; and in order that the combination should be achromatic the distance between the lenses must be equal to half the sum of their focal lengths. Thus $\frac{3+1}{2}=\frac{4}{2}=2$ in. (2) That to find the single lens equivalent, divide twice the product of the focal lengths of the component lenses by their sum. Thus $\frac{3\times 1\times 2}{3+1}=\frac{6}{4}$

the component lenses by their sum. Thus $\frac{1}{3+1} = \frac{1}{4}$ = $\frac{1}{4}$ in. (3) That in a refracting telescope the distance between the object-glass and the eyepiece is the sum of their focal lengths. Supposing the object-glass to have a focal length of 40 in.; then the distance between it and the eyepiece would be 40 + 1 + 1 + 14 + 1. Now in a terrestrial eyepiece the ersector combination of lenses takes the place of the astronomical eyepiece, and is so arranged that the principal focus of the field lens coincides with the small inverted object formed by the object-glass at its virtual focus. Both the lenses of the erector are plano-convex, and are arranged with their plane sides towards the object-glass. The lenses of the erector combination may be secured in a tube similar to the astronomical eyepiece and in the same manner. Then a larger tube, which slides over the tube containing the erecting lenses, having been obtained and placed in position, the astronomical or magnifying eyepiece is inserted at the other end. Distinct vision is obtained by means of the sliding tube in the eyepiece, which alters the relation of the magnifying with the erecting



Setting Out Van Tilt.

pine; this ranges from llin. to l7in. or l8in. wide for ordinary work, and for special jobs the writer has had 3-in. pines, 2ft. 4in. wide, run out at lin. and \(\frac{1}{2}\) in. Put on the bottom length first, then work from the centre of the root; the corner panels must be bent to fit the corner by wetting the outside of the board, and holding it a little distance away from a hot stove-pipe, being careful not to get too much bend, or the panels will crack when being put on. For a miller's or coal van, a canvas or saileloth covering is made, and tied on the van by eyelets let in round the bottom edge.

lets let in round the bottom edge.

Destroying Vermin by Fumigation.—First close all inlets in the room, and then place in the centre of the floor a large shallow iron or earthenware vessel containing about 4 lb. of flour sulphur mixed with 4 lb. of cayenne pepper; set fire to this preparation and securely fasten the door. The sulphur pepper mixture should be allowed to smoulder for 'about twenty-four hours. In an exceptionally bad case, the stoving should be repeated; anything, such as paper, that would prevent the sulphur fumes penetrating the corners and crevices of the walls and floors should be removed. After the stoving, wash the walls with strong carbolic acid diluted with water.

with water.

Adding Terrestrial Eyepiece to Astronomical Telescope.—Terrestrial eyepieces are made in two patterns. In one the lenses have a fixed relation to one another. This pattern is fitted to all ordinary draw telescopes for day work. In the second pattern, known as the pancratic eyepiece, the relation between the magnifying combination and the erecting combination may be altered at will; and each alteration in the relation produces an increase or decrease in the magnifying power. Terrestrial eyepieces, therefore, consist of four lenses arranged in two combinations of two lenses each. The first pair shows the inverted object, the second pair reverses it so that it reaches the eye erect. In arranging their respective positions the following provisions are necessary. (1) That the ratio of the focal lengths of the lenses in an eyepiece is usually 3:1, the latter represent-

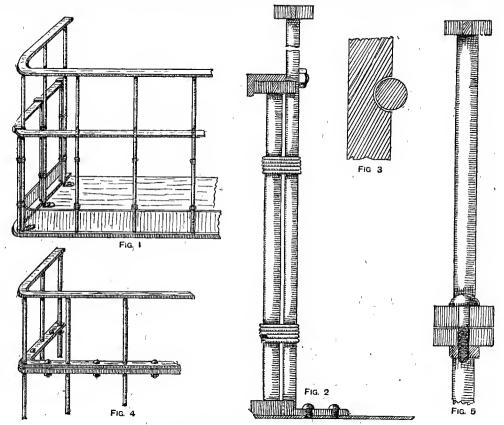
combination, and in the ordinary manner by altering the relation of the erector lenses with the objective. A diaphragm or stop inserted between each combination of lenses will improve definition. But the great point always to be borne in mind in the arrangement and combination of lenses is to be certain that all the lenses are exactly concentric around one optical axis. The least deflection of any one of the lenses will mar the entire effect. This is why all practical opticians secure their lenses in metallic cells. Other methods are never satisfactory.

Stencil Cutting,—To cut stencil plates, the tools are an assortment of punches and chisels, a hammer and mallet, and a few smooth files. A lead piece hardened with a little zinc makes a bed for punching out the metal to the various shapes. Commence by drawing the letter required to size, and punch the metal through along the straight lines with the chisel; then, if the letter is a small one, punch round the curves with one of the small chisels until the metal is removed to form the letter. Flatten the burr down with the mallet on any smooth from surface, and file out clean the rough edges from the cutting operation. If the letters are of large size, cut them along the straight lines as above, punch a round hole at suitable places, and as large as possible between the curved lines, and then with a pair of bent-nosed snips cut round from these holes on the curved lines of the letter. The edges are then made smooth, and the metal is flattened as described. Sheet zinc or similar material is suitable for stencils.

Hardening Copper Wire.—Copper wires and phosphor-bronze wires can be hardened only by drawing them through a draw-plate, or between straightening pins, or by some other method of compression and friction. If the wire has been made very soft by anuealing, it will stretch and become smaller by the drawing process; but it is not necessary to make it much smaller to harden the wire. Impure copper will harden quicker than pure copper.

Increasing Height of Nursery Fender.—There are several excellent methods of increasing the height of a nursery fender, two of the best plans being here described and illustrated. Fig. 1 shows the end of the fender with the addition made by fixing behind the present rods round iron rods, and riveting these to the top rail, which may be either of flat iron or half-round brass. The bottom ends of each rod should be flattened out, and turned at right angles, and then screwed or riveted to the bottom plate of the fender, as shown in Fig. 2. These rods should be fastened to the main rods of the fender with wire, as shown, and also with a clip which fits over the upper rail of the existing fender, and which is fastened to the new rods with screw and nut. The upper rail of the present fender should be filed out, as shown in Fig. 3, to let in the new rods. Fig. 4 illustrates another method, a second rail of flat iron, with the round rods of the required additional height riveted into it, being fastened on to the present top rail of the

dissolved in dilute hydrochloric acid, the solution brought into a platinum dish, and excess of pure caustic soda added. The soda must be prepared from sodium. The precipitate of oxide of iron is filtered off, washed until free from alkali, dried, ignited, and weighed. The solution from the oxide of iron is acidified with acetic acid, and the alumina precipitated by ammonia; this is also washed, dried, ignited, and weighed. The solution from the oxides of iron and alumina (a) is boiled, and ammonium oxalate is added; this precipitates the lime as oxalate, and it is filtered off and treated as the other precipitates. The filtrate from the lime is rendered alkaline by ammonia, and sodium phosphate added; after standing overnight all the magnesia will be precipitated. The precipitate is collected on a filter paper, washed with water containing ammonia, then dried, ignited, and weighed. The magnesium phosphate is calculated to magnesia by multiplying by \$\frac{1}{2}\$. The alkalies are determined in the re-



Increasing Height of Nursery Fender.

fender by bolts and nuts, as shown in Fig. 5. The second is perhaps the easier method: A half-round brass top may be fixed on the upper rail of the new portion if desired, and the wirework should be made in the required length, and fastened to the round bars with wire ties.

Analysing Fuller's-earth.—The analysis of fuller's-earth is a long and complicated operation, requiring considerable skill. A portion is carefully weighed and the moisture determined by drying in a hot-air oven at 110°C., and again weighed; the combined water is then estimated by ignition, and, after cooling, again weighed. A portion is next weighed, boiled with concentrated sulphuric acid for several hours, and then allowed to cool. The mass is diluted with water, the silica is filtered off, washed with water until free from acid, dried, ignited in a platinum crucible, and weighed. The solution and washings from the silica are made up to a definite volume, say 500 c.c., and half of this is taken and to it is added ammonium ciloride and ammonia, and the solution is boiled till it smells no longer of the ammonia. The precipitate (a) is filtered off and washed. It is

maining half of the original liquid; ammonia and ammonium carbonate are added in excess, the solution is filtered, then evaporated to dryness, and geutly ignited; water is added to the residue, and the solution is again filtered. Pure milk of lime (free from alkaliss) is now added to the filtrate, the solution is again evaporated to dryness, more water is added, and filtered, carbonic acid is passed through the filtrate, and, if any precipitate occurs, this is also filtered off. The solution now contains the whole of the alkalies (potash and soda) as carbonates. Dilute hydrochloric acid is added in slight excess, the solution is evaporated to dryness in a platinum crucible, gently ignited, and weighed. Then the chlorides (KCl and NaCl) are calculated to alkalies (K2O and Na₂O).

Converting Cycle Wheels to Band-saw Wheels.—In-converting cycle wheels to band-saw wheels, fill in the grooves of the wheels with segments of light seasoned wood. These segments should be turned off perfectly true and fiat. The rims should then be covered with a band of leather or rubber. Such wheels should be used for light work only.

Niello Inlaying.—Niello is an Italian name given to a peculiar kind of ornamental metal work. Niello is composed of an alloy of silver and lead, or of silver and copper, blackened by the admixture of sulphur. The process employed in working is similar to that of enamelling. The plate or other article, which should be of gold, silver, or copper, is first engraved with the design, and the alloy is laid in the incisious in grain and melted in, either with a blowpipe or in an annealing firmace. The only colours that, so far as is known, are used in connection with inlaying of metals are black (oxidised silver), white (silver), red, yellow, and green (alloys of gold). These metals are melted in the cuts, using the ordinary fluxes as for gold and silver. The proportions must be found by experiment. The work is then filed off level and polished.

Repolishing Steelwork of a Watch.—A large surface such as the cap that screws on the winding ratchet of a keyless Geneva watch is difficult to polish, and considerable practice will be required to do the work. A solid block of bell metal, fatted and stoned smooth on one side, will be necessary. This is covered with a thin paste of fine red-stuff or diamantine and oil. The piece to be polished is rubbed across and across and round and round on the polishing block. A peg inserted into the central hole serves to operate it. These surfaces are never burnished. A clean grey will look better than a bad polish, and can be gained by rubbing the steel piece on a piece of fine ground glass with oilstone dust and oil. This is a much easier process.

Portable Form.—The portable form illustrated in front and end elevation by Figs. 1 and 2 may be packed away in small space for easy conveyance as required. It will be seen that simply by lifting the seat right side up the legs and brackete fall into position and will so

differences in quality. Thus he may export six grades or qualities of material.

The first quality will have JBN on the end, second quality will have JBN on the end, third quality will have JBN on the end, fourth quality will have JBN on the end, fifth quality will have JBN on the end, or if, instead of firsts and seconds, a mixed grade is substituted (consisting of mixed firsts and seconds), the mark will probably be JBB.

John Brown makes no secret of these marks, and would gladly inform any inquirer of the significance (as to quality) of any given brand. In fact, he is at much pains to advertise the fact that these classes of material are manufactured by him, and that the above arrangement of initials is to be taken as an indication of the comparative qualities of the stuff. The two real examples given below will show how the matter works out in practice.

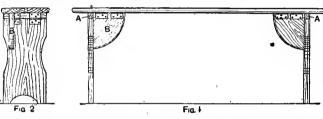
(1) The Holmsunds Aktiebolag (Holmsunds Share Company) manufacture and export sawn goods and planed goods from Holmsunds, Sweden, and the following is their advertised quality code:

SAWN GOODS.

PLANED GOODS.

SAWN GOODS. PLANED GOODS. DDDDOSS Firsts Seconds Thirds Mivad Thirds ... Fourths Thirds HLND Unscrted (Sawn or Planed). HSUND Fifths Sixths Inferior sixths...

Here, obviously, the word Holmsunds has been made use of as the base for quality variations.





(2) The Fagerviks Travarw Aktiebolag, a sawmilling firm in the Sundswall district of Sweden, exports under the following marks (also, very clearly, derived from the

Fig. 3

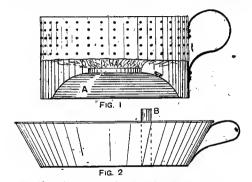
list of names and addresses of manufacturers, and of the initials and symbols that are peculiar to the productions of each. Such a list has been constructed, and is in general use by timber merchants and all connected in any way with the timber trade. Lastly, the marking, when applied to logs, assumes several new characters that require too lengthy a treatment to be considered here. It may be said, however, briefly, that frequently group numbers, cutting numbers, private sub-owner numbers, and marks, contents marks, and even dates, are sometimes placed on the ends and sides of logs.

Bleaching Straw.—Straw may be bleached by boiling it in a solution of washing soda, washing in water, steeping in a solution of bleaching powder (chloride of lime), and then in a solution of bisulphite of soda, finally washing with water. If to be treated on a large scale, the straw, after the preliminary treatment with washing soda, should be bleached by sulphurous acid gas in a properly constructed chamber.

remain. Should it be desired, the brackets could be fastened to the legs by hooks and eyes. The form will collapse if the brackets are lifted and the legs are allowed to drop inwards. After having planed the wood to size and cut the legs to shape, a fillet A (Figs. 1 and 3) of the same thickness as the legs should be glued and screwed to the under side of the seat. The legs should be hinged to the fillets, as illustrated. Next two brackets B should be hinged to the under side of the seat near the back edge. seat near the back edge

Quality Marks and Shipping Marks on Timber.—
The following are general remarks respecting the various brands and shipping marks on timber. The difficulty of identifying parcels of timber consigned in the same freight, or stored in the same place, but belonging to different owners, was no doubt the original reason for the introduction of a marking system, and the extension of the system to marks that indicate quality was the natural sequel to the marks of ownership. There is nothing mysterious or cryptic in this system of timber marks, nor should the various marks be regarded in the light of a secret code; the great increase in the number of manufacturers and the consequent multiplication of brands are the only causes that have brought about any obscurity that may be thought to exist. There is also generally an entire want of organisation, each new manufacturer being alsothought to exist. There is also generally an entire want of organisation, each new manufacturer being absolutely at liberty to adopt any brand or mark that he may think fit to adopt; and though, in most cases, respect is paid to old-established marks, plenty of examples of repetition and overlapping exist. Reduced to simple terms, the system (if system it can be called) resolves itself into a parallel of the imaginary case described below. John Brown is a sawmill proprietor and forest owner in Sweden. He manufactures sawn wood goods for the English market, and in order to distinguish the goods produced at his mills from the goods of other sawmillers he stamps or stendis on the end of each piece a more or less abbreviated form of his own name; and, at the same time, uses variation in the arrangement of the lettering in order to indicate Making Ice.—The commonest method of freezing for ice-cream making is by a mixture of poundedice and rock-salt; this will give a temperature of -5 F. This method is not applicable to the preparation of ice because of the large amounts of materials required to produce any appreciable effect. Mixtures of other salts with water or with ice are also sometimes used, but they are expensive, and it then becomes necessary to evaporate the solutions in order to recover the salts for use again. The heat required necessitates the use of a much greater amount of fuel than would be the case if some form of freezing machine were employed; hence, though the initial expense is greater for the latter process, it is generally employed where ice is to be made or any amount of cooling is required. A small machine to make about a ton of ice a day would cost at least £100; there are no machines made of a capacity of a few pounds of ice a day.

Heating Apparatus for Turkish Bath Cabinet.—
For a Turkish bath cabinet sufficient heat can be generated either with gas or methylated spirit. Fig. 1 represents a cylindrical perforated metal lamp container, and fiame guard of a methylated spirit lamp. The apparatus should preferably be made of copper, and the handle should be riveted on. The spirit lamp proper is shown at A. A simple heat radiator consists of a disc of metal to which three forked legs are riveted so that the forks will fit the top of Fig. 1. This lamp can be used for a Russian or vapour bath, but a vaporising pan as Fig. 2 will also be required. This pan is of metal plate, and rests on the top of Fig. 1 when in use; the heat radiator previously described is, of course, lifted off. B (Fig. 2) is an open-ended tube, a small chimney practically, one end of which is attached to the bottom of the pan, where a hole has been cut for the purpose. The heat



Heating Apparatus for Turkish Bath Cabinet,

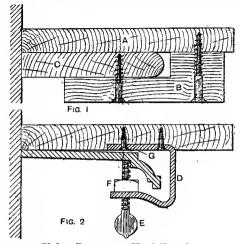
passes through this tube, and is distributed by means of a smaller radiator, which is attached, similar to the other one. A large amount of heat is thrown off all round through the perforated flame guard. About 1 pt. of water is required, and the best spirit should be used. For heating the cabinet with gas, for the spirit lamp substitute a small concentric Bunsen hurner. This can be fitted to the nearest gasfitting by a piece of copper pipe and a length of indiarubber tube. The apparatus above described can also be utilised for numerous domestic purposes.

Annealing Derrick and Crane Chains.—It is necessary that derrick chains be annealed at the termination of every large contract, or say, once in three years. Crane chains in constant use require more frequent attention, but unless the chains show signs of wear they will not require annealing more often than derrick chains. The annealing should be done by supporting the ends of three or four old rails ou brick piers, and making a wood fire beneath the rails. A piece of old sheet-iron for the chain to rest on may be laid on the rails, or the chain may be laid backwards and forwards across the rails themselves. The fire should be kept up until the chain is a good red heat all through; the chain may then be drawn off with an iron hook and covered up in the wood ashes, and left to cool. The chain should, when cool, he drawn out and laid straight, then carefully examined link by link, especially at the welded ends. On any defective or doubtful link a piece of string should be tied, and any part that is much worn should be marked in the same way. A second opinion may then be obtained, and, if necessary, the bad links or the worn part of the chain may be cut out and replaced with new. The handling of the chain in this manner generally removes all scale and dirt, and leaves the chain a clean

bright red. The chain should now be laid out on a wood floor, and oiled thoroughly with a brush and mineral lubricating oil, but not with linesed or boiled oil. The objects of annealing are, (1) To restore the quality of the iron and relieve it from the fatigue due to work; (2) to remove all oil and dirt so that the condition of the links may be more closely examined; (3) to permit the chain to be more thoroughly oiled before being put again into use.

be more thoroughly oiled before being put again into use.

Fixing Temporary Mantelboards.—The fixing of a mantelboard is a difficult job, and as it is oue to which the amateur carpenter's abilities are usually first turned, the following particulars will probably be found useful. A temporary board is generally fixed because the existing one is too small. Sometimes the existing one is too small. Sometimes the existing one is of wood, and in that case the method of procedure is as shown in Fig. 1. To the under side of the temporary board A pieces of wood B about 21n. thick and 3 in. wide are screwed about 1 ft. 3 in. apart: they are ripped out, as shown, to fit over the existing board C, to which they are screwed. When the existing shelf is of iron, as in Fig. 2, it will be necessary, in order to avoid the risky and frequently unsuccessful expedient of driving nails in the wall, to get a blacksmith to make some lugs D of about \$\frac{1}{1}\$, in. by \$\frac{1}{2}\$ in. mild steel, well tempered. They are let in and screwed to the under side of the shelf as shown, and a fly bolt E is passed through a hole in the lug and then through the nut F. If the nut



Fixing Temporary Mantelboards.

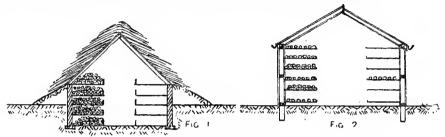
is held in the hand and the bolt screwed up, the nut will force the lugs out and sufficient pressure will be exerted to establish a firm fixing; the bolt should catch against the front of the iron shelf, as shown, and the lugs should be about 1t. to 1ft. 6 in. apart. Iron shelves generally slope to the front, but the inclination is often not enough to affect articles standing on the slope, and if it is much, the upper shelf will be brought right by inserting some wedge-shaped chips of wood at G.

Welding Iron Cylinders.—To weld up iron cylinders or tubes 30 in. long, 18 in. in diameter, and No. 10 or No. 12 B.W.G. thick, an open hearth with an upright blast will be best. It is possible to weld the cylinders with an ordinary forge and blast, but with the upright blast the fire will not spread so much, and this will be an advantage owing to the thinness of the plate to be used. Great care must he taken to have a clean fire, good firing, and a continuous blast. When getting the welding heat, use a steady blast until the iron nearly reaches the welding point; then force the blast so as to bring it to the welding heat sharp. If a flux is needed, some clean sharp sand will be found all that is necessary; but it is well to try to avoid using a flux.

Boring Bagpipe Chanters.—A bell chuck on the lathe mandrel, with a deep hole in it, is essential for boring bagpipe chanters. The wood is turned to fit the chuck at one end, and driven tightly in. Sometimes a shell bit is used, and sometimes a twist drill, but in any case a long thin shank must be welded on it, and it has to be used with great care. The hit is pushed up by means of the back centre, the feeding being done very slowly, and the bit heing withdrawn very frequently to clear the hole and to keep the bit from heating. The tapering of the bore is best done by hand with a tapered shell bit.

Shed for Storing Apples.—For storing common kinds of apples the form of shed shown in sectional view in Fig.1 will be suitable. Mark out the ground for the building, 10 ft. wide, and length according to requirements. Then excavate the soil to a depth of 1 ft. 6 in. or 2 ft., according to the means of thorough drainage. Next build a wall 4 in. thick, and 4 ft. high from the excavated level at each side, and use the surplus soil to form a solid bank at the outsides to the top of the wall as shown. Then form the roof of rafters, which may be either ordinary spars or simply rough poles, and cover the whole with a coat of thatch at least 15 in. or 18 in. thick, and coming down well over the banks at each side. The inside is then fitted up on each side with four shelves 3 ft. in width, and leaving 3 ft. for the path. These shelves may be of any rough boarding sawn to about 3 in. or 4 in. wide, placed with 1 in. spaces between them, and provided with a ledge 6 in. high in front to keep the fruit from falling off. At one end a double door should be fitted, and at the other end a double window, which should also have a shutter to exclude the light. The earthen floor should be left uutouched, to ensure sufficient moisture to keep the fruit plump. The apples may be placed in layers four or five thick. In such a structure, with shelves 3 ft. wide, 1 bushel of fruit will occupy about 2 ft. length of shelf; so that a building 100 ft. long would provide accommodation for 400 bushels of apples. When placing it in the store, be sure that the fruit is dry, and free from damaged and diseased specimens, and also that it is fully ripe. For the first week or two the apples throw off considerable moisture; therefore, immediately after placing them in the store, plenty of ventilation should be allowed until the fruit ceases to perspire. After this the fruit may be kept close, a little ventilation being given occasionally. After the store

is placed in the path of the rays, their direction is changed and they are reflected downwards and received in a horizontal position on a table. The cheapest form of lens to use is a double-convex lens of 3 in. diameter and 8 in. focal length. But probably the best for the purpose is an ordinary photographic objective of 9-in. focus. The position of the mirror depends on the inclination of the path of the rays through the lens. If the mirror should be arranged at an angle of 45' to that axis, and the rays will be transmitted perpendicularly downwards. If, however, the optical axis is tilted from the horizontal, and if it is still required that the rays should proceed perpendicularly downwards, then the mirror must be arranged similarly, for the angles of Incidence and reflection are always exactly alike, and a line drawn perpendicular to the plane of the mirror at the point of incidence will be situated midway between the two paths of rays. The distance between the objective and the reflector is fixed by the focal length of 9 in., that will be the distance between the two. The best method of arranging the lens and mirror of a camera obscura is on the conical roof of a circular chamber specially devised for the purpose. The walls of the chamber may be of corrugated iron, wood, or canvas connected at the top to a rail which runs round the entire circumference of the chamber. The roof is conical in shape, and if it is desired to obtain pictures of the surrounding country, the chamber should be fitted with wheels, which would run on the rail at the top of the circular wall. At the apex the roof is circular and has a vertical wall to which the objective and mirror are attached. The height at which these are fixed and the size of the picture received on the table stand in direct ratio to



Shed for Storing Apples.

has been once used and emptied, it should be thoroughly cleansed. It should then be fumigated with burning sulphur, every crevice being first closed, to destroy all insects, larvæ, etc.; and, shortly before being again used, it should be well limewashed. For best apples, or where a number of varieties for dessert use have to be stored, the building should be more commodious, so as to give more room for examination and selection of fruit. The shelvee may be only 9 in. or 10 in. apart, made of laths as in the former case, and covered with a thin layer of clean straw, on which the apples should be laid not more than two deep; if room can be allowed, one layer of fruit only is preferable. Artificial heat should not be introduced, and light should be excluded as far as possible, as apples keep better and retain their freshness more perfectly in the dark than in the light. If economy is no object, a wooden building arranged as Fig. 2 may be erected, but it will be necessary to provide double doors, double walls, and double windows; and the opstition chosen should be as sheltered as possible, as the chief thing to avoid is a sudden change of temperature, although no anxiety need be felt if the temperature should fall two or three degrees below the freezing point during a continued frost. In such a case, if the room is kept close for some time after the thaw has set in, the temperature will gradually rise, and no harm will be done. doně.

done.

Camera Obscura. — The camera obscura or dark chamber is sometimes used by artists for the purpose of laying in the outlines of landscapes, and, as its name implies, it is a closed space impervious to light. In its simplest form it consists merely of a small circular aperture in the wall of a room from which all other light is excluded. The rays proceed from the external object and pass through the aperture, forming on the opposite wall an image of the object in its natural colours, but of reduced dimensions and inverted. By fixing a double-convex lens in the aperture and receiving the image on a white screen, the picture is made much brighter and more definite. But this method of receiving the rays is inconvenient, as the image is defined in a vertical position. Now if, for the sake of convenience, a plane mirror

each other. For instance, if the equivalent focus of the lens is 9in., then the distance between the points of incidence on the mirror and table should be 9 ft., and a picture disc 3ft. in diameter will be received on the table top. There is no absolute need to erect a special chamber at any great outlay, for if the arrangement is fixed at the apex of an ordinary bell-tent the same result is obtained. It only becomes necessary to devise some method of rendering the position of lens and mirror alterable at will, and this is simplified if the lens and mirror are connected by means of a rod. This rod should have at one end a ring into which the objective could be screwed, and at the other a clasp which would receive a holder attached to the mirror. By this means the mirror and objective are retained at their correct positions, and when necessary the inclination of the mirror can be altered as desired.

Hand-made Lead Syphon Trap.—The best method

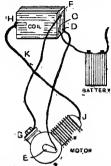
and when necessary the inclination of the mirror can be altered as desired.

Hand-made Lead Syphon Trap.—The best method of constructing a hand-made lead syphon trap with soldered seams at the sides is described below in brief. First provide a solid wood pattern of the size and form of the syphon trap that is to be made. Then cut out the two pieces of lead to the proper size, which can be found by measuring the wood block; bend one piece in position on the block and work down the sides, and then treat the other piece in a similar manner. Carefully fit together the halves thus made, and solder the seams either by wiping or drawing. North Country plumbers are very handy at such work, and frequently make such traps without any core or block. If the trap is to be made without a block, cut out the two pieces of lead to the proper sizes, plane the edges straight, and then dress the pieces of lead separately on a round wood mandril; a piece of cast-iron rainwater pipe will do for the mandril. On the bench make a full-size drawing of the trap, lay each piece of lead on the drawing in order to mark the position of the throat and the heel of each bend respectively, and open the sides of the curved pieces of lead and bend them on the drawing; then work the sides inwards and outwards (as the throat or the heel is being dealt with), carefully fit the two halves together, and solder the seams.

Ribbon of Bruges.—Ribbon of Bruges—the familiar tape which when burning gives off a strong perfume—is made as follows. In one bottle mix together 100% of extract of orris root, 40% of gum benzoin, and \$\frac{1}{2}\$ oz. of gum myrrh with \$1\frac{1}{2}\$ to f rectified spirit. In another bottle place \$\frac{1}{2}\$ oz. of pod musk and \$1\text{dr. of oil of roses. Steep unsized cotton tape or thin blotting-paper in strips in 10% of saltpetre dissolved in 1pt. of warm rose-water, and allow to dry. Then mix the two solutions, filter through a piece of muslin, and steep the ribbons in the solution; then dry them again, and they are ready. As the musk is avery expensive article, it may be left out, or replaced by infusion of musk.

Hardening Felt of Piano Hammers.—A hot iron (as used for laundry purposes) held against the tips of piano hammers will sometimes harden the felt; if this method is unsuccessful, then try dipping a piece of rag in clean water, place ito ver the felt, and press with the hot iron. The weak tone of an instrument may be due to the use of a cheap soft quality of felt. Or the action may not be in its proper place; it should be secured by buttons to prevent its springing away by frequent use of the foot pedals.

Electrical Connections for Petrol Motor.—The accompanying illustration shows the wiring of coil, battery, and motor, and it is as follows. From the positive terminal of the battery to the positive terminal on the coil marked 0, from the terminal D on the coil to the contact breaker E on the motor, from the terminal F on



Electrical Connections for Petrol Motor.

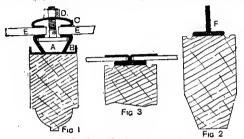
the coil to some nut G or bolt on the motor, and from the terminal H on the coil to the sparking plug, and from the negative terminal on the battery to the switch or interrupter. The wire K is a high tension wire.

marqueterie Staining.—Some splendid specimens of marqueterie staining have been done with tube water colours; these, however, do not give good imitations of inlaid woods, but produce what appear to be copies of posters or glazed tiles. These pigment colours do not readily bite the surface of the wood, but are readily fixed to enable the surface to be polished by spraying or brushing over with isinglass. Use about \$\frac{1}{2}\text{ox}\$. dissolved in \$\frac{1}{2}\text{ pt}\$ of water, which when cold should form a jelly. Apply with a piece of very fine Turkey sponge or camelhair brush, working from top to bottom. Do not have the brush too wet, and avoid going over the same place twice. When the first coat is dry, apply a second coat, this time crosswise to ensure that every portion is covered. If isinglass is not at hand, clear varnish or white polish may be used, provided it is not so thick as to dry out in ridges. The colours when fixed may be polished in the usual manner adopted by French polishers, except that no grain fillers are used. The liquid wood stains sold at paint and drysalter's stores are simple in use and reliable, as they strike well home and do not readily rub off, and moreover give good mitations of the woods they are intended to represent. The stains are also sold in powder form, and are capital for outlining purposes. Brown and black are mostly used, and they must be much stronger or thicker than in the body of the design. The mixtures sold as combined stains and varnish are unsuitable for this purpose. Vegetable stains are highly commended, aniline dyes being apt to fade on long exposure to strong sunlight. The vegetable dyes are troublesome to make, and it is difficult to guarantee that a second lot of dyes, if required, will exactly correspond with those first made. Vegetable dyes generally need a fixing medium, which is included amongst the est. When no such medium is at hand, try ordinary gum if the dyes are made as water stains, or 4 oz. seed lac dissolved in 1 pt. methylated

spirit for spirit stains. The process of polishing this decorated work is exactly the same whether colour pigments or stains have been employed. Polish made from bleached shellac should be used, thus ensuring it will stand out clear. The chief thing to guard against is breaking up any lines, or causing the colours to rub off and give the work a smudged appearance, and this is best accomplished by applying polish lightly at first, not having the rubbers too wet, and placing the work aside for a few minutes at a time to enable the polish to set, if not harden.

Thickening of Olive Oil.—The behaviour of olive oils varies with the temperature at which they were expressed. It may be taken, however, as a general rule, that they thicken at about 50°F, and are solid at 32°F, (the freezing point of water). Even at the freezing point they are not really solid, as on shaking or pressing much oil can be got out. Olive oil has the highest solidifying point of any vegetable oil; the other oils of a vegetable nature will stand a much lower temperature without solidifying.

Leaky Glazed Roofs.—A roof of glass resting on wooden bars in the ordinary way and puttied will sometimes be found to leak during rainy weather, although the roof may be comparatively new. Leakage through a roof frequently occurs when the bars or rafters that support the glass have been given too long a bearing, and consequently sag in the centre and break the putty joint, and also when the glass is cut too slack in the width. In the case of sagging, additional support should be given by screwing a piece of flat iron to the under side of the hars longitudinally, so as to support each bay of the roof. Of the new methods of glazing that are preferable to the old system, one is Rendle's



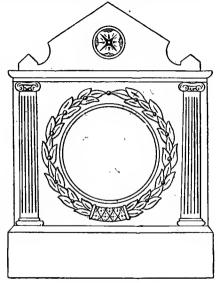
Defective Glazing to Roof.

Patent Invincible system (see Fig. 1); on the wood bar is fixed a zinc water channel with condensation gutters A B on each side, and on the top is a cap C, the glass E being held in position by the screwnut and bott D. Figs. 2 and 3 show Grover's system; on the wood bar at the top edge are two hollow grooves for condensation, and on the centre part are fixed 3-lb. lead slips F (Fig. 2), the glass lying on the lead, the web being turned over on each side tight to the glass (Fig. 3).

sharpening Pinking Machine Cutters.—Circular cutters for pinking and scalloping may be sharpened as follows, the temper first being drawn. First soften the cutter by heating it to a blood red, and allow to cool. Then place it in a vice between two pieces of brass or lead (this will prevent the vice damaging the cutter), and file to a knife edge, using a smooth half-round or three-square file, whichever is more suitable. If the cutter has small pieces broken out, it must be re-turned in a lathe before sharpening. The cutters are hardened and tempered as follows. Heat equally to a blood red, and dip in oil, then allow to cool thoroughly; next polish all over, using emery cloth on a file (be careful not to allow the emery to rub off the knife edge). When thoroughly clean, heat a piece of gas-pipe or iron of the same size as the hole in the centre of the cutter; this will temper it, or let it down as it is called. The right temper will be determined by a dark straw colour, which will proceed from the centre outwards; it may be necessary to re-heat the pipe or iron to gain the right temper, but the cutter should be slowly turned round on the pipe or iron to ensure the heat being distributed on the pipe or iron to ensure the heat being distributed equally. When the cutter is the proper temper, dip it in cold water. Another way of tempering cutters is as follows. Bend a piece of thin sheet iron at right angles; hold this in a vice, so that it will form a table or platform. After the cutter has been hardened and cleaned as described above, put It on top of the sheet iron, place a lighted gas jet underneath, and carefully watch for the dark straw colour; then dip the cutter in cold water. It may be necessary to keep moving the cutter about to distribute the heat equally.

Stamping Small Brass Labels.—The small brass labels such as are fixed on cycles are stamped from very thin sheet brass, a small stamp hammer being used for the purpose. An engraved die is necessary for this work, and a force composed of lead (perhaps slightly hardened with zinc) would assist the die in giving a much better impression, and would save the cost of a second die. If a small hand-press is available this would answer excellently and give good labels. When the labele are ready (they might perhaps require two blows), the edges will need trimming and afterwards dipping and burnishing, and finally lacquering.

Marble Clock Case.—Herewith is a design for a marble clock case that ie about 15 in. high. The novice in marble work is advised to use white statuary marble, because it is easily cut and can be finished without the difficult and tedious process of polishing which dark marbles demand. Sicilian marble, which is much cheaper, might serve the purpose, but is harder than white statuary marble, and has grey veins. It will be easier to work the clock case in one piece, as neat joints could not be made by an amateur. For hewing out, a heavy stone must be arranged at a convenient height, and the marble fixed to it with plaster-of-Paris. The tools needed will be a sculptor's hammer, six chisels, marble tools, and two or three sculptor's rasps. The rough-hewing is done with picks—chisels which have pyramid-shaped points. After rough-hewing, the chisels proper are used, and must not be held too nearly per-



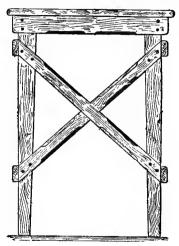
Marble Clock Case.

pendicular to the surface, or there is danger of bruising the marble. When the surface is almost reached, the rasps are used, and then the glasspaper. The actual finish is obtained by "sanding"; in this process fine sharp sand is worked with water over the marble with a bit of pine wood shaped something like a human thumb, a circular motion being maintained. This brings out the brilliancy of the material. If, however, the marble is of a kind to require actual polishing, the surface is instead rubbed down level with sand and water, then made still smoother with "cream grit," and finished with putty powder on felt. With light marbles this tedious work may be avoided. In the design shown, an amount of ornament has been introduced, but this, marble is used. The central opening can, of course, be cut to suit the size of lock.

Fitting Petrol Motor to Cycle.—If the cycle and motor are both to be built, a very different class of motor would be required from that which would be fitted to an ordinary cycle not built to carry a motor. Given a good, strongly built roadster, a light motor such as the Clement-Garrard may be fitted with safety provided the front forks are suitably strengthened, and the reader is advised very strongly not to fit a motor to an ordinary cycle without this part is strengthened. A very effective strengthening may be obtained by fitting two \(\frac{1}{2} \)-in. tubes from the wheel spindle

to the ball head clip, which should be turned round so that the ears through which the adjusting pin passes are in front instead of behind. The flattened ends of the tubes may then be drilled to suit the pin, and then secured to the clip by the pin and nut, the lower ends slipping over each end of the wheel spindle under the nuts. The tubes must be secured to the fork crown by two tube struts or stays, which may be lap-jointed and brazed. The back forks, and probably the top stays, will require cranking out to allow clearance for the belt pulley. Another pattern motor, of the two-stroke cycle variety, fits on the head of the machine, and drives the front wheel from a rubber-covered pulley on the motor on to the tyre. This involves the least outlay, and requires less alteration to the bicycle.

Simple Wooden Stool.—The stool illustrated is four-square; all its sides are alike, and therefore the one elevation given will serve for the whole. It is 19 in. high, 14 in. wide across its top, and 12 in. across its legs. Soft wood will be best for it. The legs are 18 in. long, and taper on their inner sides from 1½ in. square at the top to 1 in. square at the bottom. The strips which surround the top are of ½ in. board, ½ in. wide and 13 in. long. They thus overhang the legs ½ in. Their ends are slightly rounded, and they are screwed to the legs. The top, also of ½ in. board, is 14 in. square. Its edges are rounded, and it is screwed down to the legs and strips. The four pairs of diagonal braces are 1 in. square and 1ft. 5 in. long. They are halved where they intersect at their middles, and also where they rest on the legs, and are fastened to the latter with round-headed screws. Their ends do not mitre, but are rounded off to the corners of the legs. Each pair is also fasteued together by a round-headed screw in the middle. If, instead of a



Simple Wooden Stool,

plain board, a stuffed top should be preferred, it may be well to keep the top piece flush with the side strips, that is, 13 in. square. The covering may then be fastened with ornamental studs along the middles of the side pieces.

Preserving Croquet Balls.—It is doubtful whether anything can be done to croquet balls which have split other than filling in the cracks with hard composition (French glue and peaflour, or shellac and beeseax). Balls that split have been badly looked after probably—perhaps left for a long time on the damp or wet grass, and then immediately stored in a warm dry room. On the other hand, the wood may have been badly selected, or may have been worked up when not sufficiently seasoned by the maker. Croquet balls should be made of thoroughly seasoned wood only which has been left to dry in squares, not in planks, the square being only slightly larger than the finished ball. The wood selected should be close in grain, the annual rings being quite uniform in thickness throughout. The squares should be sawn from the tree as tar from the centre as possible, but not so far as to include the few last outer annual rings. The wood, previous to turning, should be thoroughly boiled and left to dry. Boiling in oil is au excellent plan, but makes the ball dead and heavy, which is a serious disadvantage unless the whole set is treated alike. The balls should be stored in a cool place, and should not be subjected to unnecessary changes of temperature or humidity.

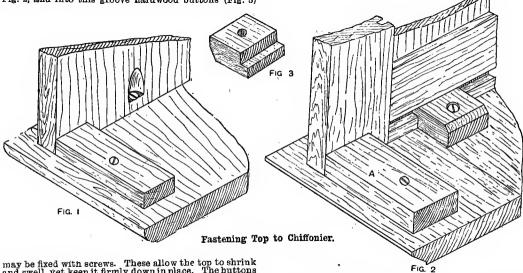
Waterproofing Playing Cards.—For waterproofing playing cards it is necessary for the ordinary process of waterproofing paper, cardboard, etc.; that is dressing with a solution of paraffin wax in hot linseed oil, to be supplemented by a second treatment of paraffin and oil mixed with a solution of shellac or any gum lac, gum resin, wax, or albumin dissolved in spirit or other mineral solvent. Talc, or a similar substance, is then strewed on the paper, and rolled in to present a smooth or glazed surface. If large quantities of cardboard are to be treated, each board would have to be dipped in the solution; or the solution could be applied with a brush or revolving rollers in a machine. Large manufacturers of playing cards have their own individual methods and recipes.

Fastening Top to Chiffonier.—The method of fixing the tops of chiffoniers, sideboards, etc., depends to some extent on the construction of the articles. When the sides are solid, as in Fig. 1, it is usual to dish out a thumb notch large enough to receive the head of the screws used, and also to allow of the point of the screwdriver turning round in it. The bottom of the notch is also dished or hollowed out, so that the screw shall bed fairly, and sink below the surface. These notches are cut with a gouge, from 6 in. to 9 in. apart and about ½ in. from the edge, and are kept as small as possible. The front rail is always fixed direct with screws through it into the top. When the side is framed, a small plough groove may be run on the inside of the top rail and flush with the front rail, as shown in Fig. 2, and into this groove hardwood buttons (Fig. 3)

paint and tlb. burnt sienna pasts paint; thin down considerably with turpentine 3 parts, raw linseed oil 1 part, and terebine 1 part, and apply over the timber with an ordinary pound brush. In order to obtain the required depth of colour two coats may be necessary. The large proportion of turpentine in the stain will render it so fluid as easily to penetrate the wood, and the raw oil in the stain will bind it and render it durable; the terebine is added as a drier. This stain will give a dull finish, which may suit some purposes; but if a bright surface or finish is required, apply two coats of outside copal varnish.

Celestial Blues.—Celestial blue, also known as Brunswick blue and reduced Prussian blue, is a pigment much used by house painters. It is similar in composition and properties to Prussian and Chinese blues to which have been added variable proportions of barytes as a reducing agent. It is prepared in a variety of shades, most makers having three shades of colour, pale, middle, and deep. The following table gives the formula for each shade.

| | Light. | Middle. | Deep. |
|---------|--------|---------------|---------------|
| Barytes | | 100 3 3 | 100 5 5 |



may be fixed with screws. These allow the top to shrink and swell, yet keep it firmly down in place. The buttons may be from 1½ in. to 2 in. square, and a trifle less in thickness than the front rail A (Fig. 2); the tongue should fit the groove hand-tight. When the tongue is in the groove, the face of the button should not quite touch the top, so that when the screw is turned in it will pull the top tightly down. A small mortise may be used instead of the groove to receive the buttons. The object aimed at in all fixings is that whilst the top is held securely down to the framing, it is free to swell and shrink without danger of splitting. For this the first-described method does not provide, therefore it should be used only when the stuff is very dry.

Cycle Lamp Burning Dull.—It is a common experience for a cycle lamp to give a good light for about half an hour and then for the wick to cake hard at the top, with the result that the light goes down. These defects may be attributed to unsuitable oil, to a stale clogged-up wick, or to bad ventilation, but if the lamp hurns well when first lighted, the trouble is most probably due to the oil or wick. Empty out the oid oil, get some best colza or sperm oil, and add about 10 per cent. of parafin and a lump of camphor. Procure a new wick, soak it in vinegar, thoroughly dry it before putting it in the lamp, and if the lamp is well cleaned a brilliant light should result. The wick should not fit too tight; in fact, a lamp will frequently burn better with, say, a \(\frac{1}{2}\)-in. wick in a \(\frac{1}{2}\)-in. burner.

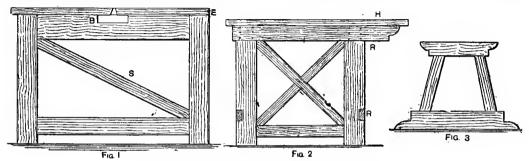
Dark Oak Oil Stain.—A dark or antique oil oak stain may be made according to the following recipe. Mix well together 31b. of pure burnt Turkey umber paste In preparing celestial blues the barytes is mixed in s large volume of water in a vat. The sulphate of iron is dissolved separately with cold water, and run into the vat with the barytes while continually stirring. The potash is made into a solution in a similar manner, and also run into the vat, mixing or stirring thoroughly during the whole time in order to incorporate the barytes with the blue. The blue will then gradually develop and precipitate or settle, the clear water is syphoned off, and the blue well washed with water and again run off, filtered, and dried ready for use. Another method which gives excellent results is to dissolve separately in water 1121b. of prussiate of potash and 1181b. of green copperas; add the two solutions together and boil for about an hour, then add 20 lb. of bichromate of potash made into a solution with water; next add 24 lb. of sulphuric acid and 4 lb. of nitric acid, and boil again with steam heat for another hour. Then run the blue which is thus developed steadily into a vat containing 16 cwt. of barytes, with a quantity of water, agitating thoroughly with large wooden stirrers during the process. The blue is then allowed to precipitate, when it is washed, filtered, and dried ready for use. Celestial blues are good pigments, permanent under ordinary circumstances, and are not affected by exposure to light and air. They can be mixed with nearly all other pigments with the exception of those containing alkaline matter, which rapidly destroys the blue and turns it a reddy-brown colour. Celestial blue should not be mixed with ultramarine blue, lime, whiting, and silicate of soda, as its colour would be rapidly destroyed, finally turning a dark brown colour.

Machine for Planing, Moulding, etc.—To do straight work only, a horizontal spindle with block and cutters, or irons, will be found to answer the purpose. These, with bearings, pulley, and a suitable fence, will have to be obtained ready made. To construct the machine, from some good red- or pitch-plne mortise and tenon together a strong frame as shown in Fig. 1. To the top rails the bearings that earry the spindle are let in at E, and secured by bolts inserted into holes bored through the rails, and tightened with nuts. The table top, which should be of hard wood, should have an aperture in the centre for the passage of the cutters as they rotate. The table may be made in halves, and secured to the frame with screws, or the front half may be hinged to the frame at E, so that it may be thrown back when adjusting or changing the irons. The stay should be reversed on the opposite side so as to act against the pull of the belt. Small holts passed through the legs crosswise and lengthwise of the bench further stiffen the frame, which must be rigid. The irous should be so adjusted that each one does its share of work. Suitable pressure springs are supplied with the fence to keep the work dead on the bed and to prevent it rising from the cutters. To drive the cutters, a belt leads to the small pulley on the end of the spindle, from a pulley on a counter-shaft. With this machine and suitable irons, planing, moulding, tongueing, grooving, etc., may be done. For irregular, and also straight, moulding a vertical spindle will be suitable. In this case, frams together a bench as in Fig. 2. Bearings are secured to top and bottom rails at R to receive the spindle. In the table at H a hole is bored, through which passes the end of the spindle that carries the cutters. If suitable pulleys for the counter-shaft are at hand, secure them

aud Stourbridge, the quality in each case depending on the relative proportious of silica and alumina and the freedom from iron oxide and alkaline salts, the presence of which will tend to render the clay more fusible. Firebricks are also made from the siliceous clays amongst the granitic deposits in various parts of Devonshire. These contain a large proportion of silica, but their powers of resisting high temperatures are largely due to the coarseness of the particles of disintegrated granite which enter into their composition, for the heat-resisting power of a clay depends not only on its chemical composition, but on the mechanical and physical condition of its ingredients. The following are analyses of some of the best known fire-bricks and clays.

| | | Silica. | Alumina. | Lime. | Magnesia. | Sesqui- oxide of Iron. | Potash. | Soda. | Titanie Acid. | Water. |
|--------------------------------------|---|-------------------------|----------|------------|-----------|------------------------------|-------------|------------|------------------|--------------|
| Dowlais Windsor brick Lee Moor | | 63·09 84·65 75·04 | 8.85 | 1.90 | 35 | 2.88 4.25 37 | 1·92 ·83 | .31 | 2·21 — — | = |
| Dinas clay Stourbridge clay | · | 98:31 63:30 | 23·30 | ·22 ·73 | _ | .18 1.80 | -1 - | ~ 4 | = | -35 10:30 |

Cheap Paints.—The cheapest paints for iron and woodwork are the oxides, red-lead and lithopoue; they are obtainable at very low prices. When mixing the oxides, base the paints as follows. Oxide of the desired



Constructing Machine for Planing, Moulding, etc.

to a piece of round iron turned off at each end to run in bearings. To carry this small shaft, two small horses may be framed together as in Fig. 3, and a bearing is fixed on each to receive the shaft. From a pulley on this shaft a belt leads underneath the bench to the vertical spindle. The work is placed against the fence (which is set at a suitable distance from the cutters) and fed through between the cutters and the fence.

Compositions of Fire-bricks.—Fire-bricks often are required to bear exposure to intense heat, as in iron-smelting furnaces, gasworks, retort benches, and glass-melting furnaces, for periods of weeks or months continuously. They must not fuse; they must be capable of being subjected to sudden changes of temperature without injury; and they must be able to resist the action of melted slag, copper, and other materials. These qualities are only to be obtained by the presence of certain proportions of silica and alumina chemically combined with water. The natural fire-claysare hydrated eilicates of alumina, their plasticity depending on the water in their composition. Silica, alumina, and lime are each separately very infusible, and are capable of resisting very high temperatures without softening, but for various practical reasons they cannot be used separately. The nearest approach to the use of silica by itself as a fire-brick is in the case of the well-known Dinas bricks from the valley of Neath, in Glamorganshire. These contain more than 98 per cent of silica. The Dinas rock from which the bricks are made occurs in conditions varying from a firm rock to disintegrated sand, and a mixture of about 1 per cent. of lime is necessary to make suitable bricks from it. Dinas bricks will stand very high temperatures, but are more friable than ordinary fire-bricks and will not resist to the same extent the action of basic substances, such as furnace slags, containing much oxide of iron. The fire-clay has the rather peculiar property of expanding when subjected to high temperatures. Other well-known fire-bricks come from Glenboig, Blaydon Burn,

shade 14 lb., patent driers 1 lb.; thin down with boiled oil 1 pt., and terebine 1 pt. Red-lead should be mixed with boiled oil alone. Lithopone should be mixed as follows. Lithopone 14 lb., pale boiled oil 1 pt., turps 1 pt., and patent driers 2 lb. Terebine should not be used in lithopone or red-lead. The other colours, as greens, yellows, and blues, may be obtained at almost any price, much depending on the body or covering power required. These paints may be cheapened somewhat by using a boiled oil and turpentine substitute, which would reduce the cost by one-third. A glossy paint much used on ironwork may be prepared by dissolving 3 lb. of common resin in 1 gal. of coal-tar naphtha ly means of a hot-water bath, and, when cold, stirring into it 1 pt. of boiled oil. This may be used as a medium for mixing with any coloured stiff paint. It dries in about three hours with a good gloss, and may be made at a very trifling cost per gallon.

Gelatine Relief from Photographic Negative.—

Gelatine Relief from Photographic Negative.—
The process of making the film of a negative or positive stand up in relief so that a plaster cast can be taken from the film requires some skill and patience, but may be worked in the following manner. Soak thin sheet gelatine in a3-per-cent. solution of potassium bichromate for ten minutes, and then squeegee the gelatine on to a ferrotype plate to dry. Drying must take place in the dark and in a well-ventilated room free from fumes of gas or oil. When dry the film can be pulled off and should be exposed behind the negative till a decided image of a pale sepia tint appears. The film should be removed from the frame and cemented with isinglass to a sheet of ground glass and placed to soak until the picture is well in relief; this will take several hours. Blot off the excess of moisture and pour a little paraffin oil over the film. Drain and edge round with some strips of card to form a tray and the mould is ready for casting. The chief objection to the process is the false relief, but where only broad effects are required this objection may be overcome by judicious retouching on the negative.

Removing Centre Wheel of Keyless Watch.—The centre wheel of a keyless watch can be removed from the bottom plate by attention to the following directions. The centre arbor generally passes through the centre pinion, and the cannon pinion is pushed friction tight on the other end. If so, and the end projects a little beyond the cannon pinion, give it a smart tap with a watch hammer and knock the arbor through. If the end is flush with the cannon pinion end, hold the cannon pinion in a pair of brass-lined pliers and the arbor back end with a pair of cutting nippers, and twist the cannon pinion off. Sometimes the centre arbor is in one piece with the centre pinion; in that case, hold the canuon pinion with a pair of brass-lined pliers and the centre wheel in the fingers, and twist the pinion off.

Camera Obsura — A simple camera obsure is shown

Camera Obsoura.—A simple camera obscura is shown in Fig. 1, A being a lens of long focus (say 6 ft. to 8 ft.) and large diameter. B is a mirror placed at an angle of 45°, and C is the receiving surface, this being a

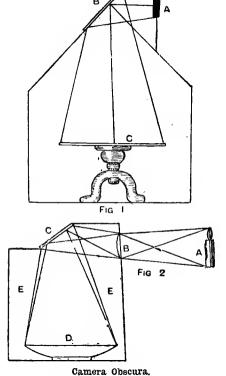


table painted a dull white. When the lens is a cheap one, definition is greatly improved if the table, instead of being flat, is concave, or cavity shaped, like a saucer. A few experiments with a candle A, as shown in Fig. 2, a spectacle lens B, a piece of looking-glass C, a saucer D, and a cardboard box E, would make the principles of construction perfectly clear.

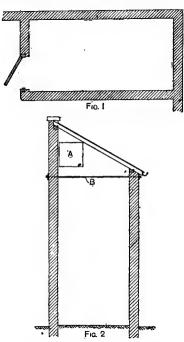
Bleaching Seaweed.—To bleach seaweed, soak it in water for tweuty-four hours with the object of softening it and to remove the salt, then steep in a solution of 1 part of bisulphite of soda in 10 parts of water for twelve hours, then add 1 part of sulphuric acid previously diluted with 5 parts of water, and allow to remain a few hours longer. Remove the seaweed and steep in water changed several times, and then dry slowly.

Dead Surface or Flatting Varnish.—The following recipe for flatting varnish is useful owing to its trifling cost and its simplicity in preparation. Warm by means of a hot-water bath, or over a fire, I gallon of ordinary white-paper or crystal varnish. Then add to it 11b. of becswax dissolved in its own weight of American turpentine. Mix the ingredients well together, and pass them through a fine strainer; then put the mixture aside to repose until it brightens, when it is ready for use. By omitting a small quantity of the beeswax, the varnish may be made to dry with an egg-shell gloss.

The more costly oil varnishes may be treated in a similar manner, adding 21b. of beeswax and double the quantity of turps to each gallon of varnish. These varnishes may be used for a varlety of purposes. Mixed with zinc-white peint, with the addition of a little more turps, it forms an excellent white flat enamel, and may then be used for interior decoration in general.

Cracks in Violin.—Cracks in the body of a violin are not caused by old age, except in so far as desiccation renders the wood more friable, and more easily cracked. The smallest crack will affect the tone of the instruent. To repair the cracks, run in thin hot glue, moving the wood on each side of the crack alternately up and down. The back or belly may have to be taken off, and the glue may require to be sucked or blown into the crack. Sometimes a thin shaving of wood is glued on the invide but this depends on the nosition. inside, but this depends on the position.

Smoke-house for Curing Bacon.—The accompanying illustrations show the construction of a haconsmoking house which is simply a room about 12ft. by 6ft, and from 12ft. to 15ft. high; the room is provided with a tight-fitting door and an outlet ventilator A near the ceiling. The roof is of glass instead of slates, in order to give light, and the walls are of brick-



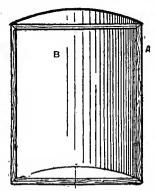
Smoke-house for Curing Bacon.

work. The only fittings required are a number of iron hars Brunning from side to side and placed near the roof. The door should he provided with a pane of glass, so that the attendant can see what is going on without entering the room. When the quantity of hacon to be cured is rather large, two or three small rooms are better than one big one.

Washable Distemper for Inside Walls.—For washable distemper, get 81b. of finely powdered Parls white, 21b. of zinc white, 41b. of plaster-of-Parls, 31b. of slaked lime, 11b. of pale concentrated glue size, 11b. of gum arabic, and 80z. each of alum and borax. Grush all the ingredients thoroughly, mix together, and pass through a fine sleve. To prepare the distemper for use, add 1pt. of holling water to each 11b. of distemper, allow it to cool, then add cold water till the mixture is the consistency of paint; apply in the usual manner. The above makes a good white, which is washable after a few weeks' exposure. When tinted colours are required, omit the zinc white, and replace with any of the following, which will resist the action of lime. For red, use Venetian, madder, and Indian reds, red oxide, burnt sienna, and vermilion; for yellow, use yellow ochre and zinc chrome; for blie, use ultramarine and lime blue; for greens, use emerald and lime greens; for browns, use raw and burnt umber, and vandyke brown.

Lever Watch Balance Staff.—To make a solid steel balance staff, proceed as follows. Cut off a length of tool steel rod and ceutre it in the lathe or turns. Rough out the whole staff, leaving it everywhere a little too large: then harden it in oil, brighten it, and temper it blue. Re-centre it in the lathe and turn the lower part down to fit the roller. Smooth this part with oilstone dust and oil, and polish with red-stuff. Then turn the lower pivot roughly and cut it to length, seeing that the roller is at the correct height for the lever. Test by standing the staff on the endstone with the hole removed. Then sight the correct height for the balance, turn its seating to a tight fit, and leave a riveting edge. Turn to fit the hairspring collet a good fit. Then cut the staff to the correct length and turn the top pivot. Finally smooth and polish both pivots, round up the ends, and rivet the balance on. Then true the balance and poise it.

Graduating Photographic Background.—Below is described a method of graduating a 6-ft. by 6-ft. plain background. The background must be painted in flatted oils. This calls for some little skill, in order to make an effective piece of work, and the finished article will hardly pay for the trouble considering the price at which backgrounds painted by artists of ability can be purchased. The effect can, however, be imitated in many



Graduating Photographic Background.

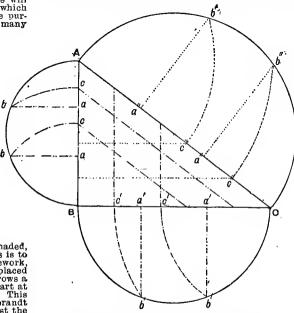
ways. The background may, for example, be shaded, and perhaps the most effective way of doing this is to mountthe background on to a convex wooden framework, as shown in the sketch. The background is then placed so that the light falls across, and the side A throws a shadow which gradually softens into the bright part at B, giving the softest gradation obtainable. This method has the advantage of ensuring in Rembrandt pictures the lightest side of the head being against the darkest part of the background, giving that brightness and solidity which are essential in a good portrait.

Polishing Scagliola.—White Scagliola, composed of Keene's or plaster, is polished as follows: Stone the surface with a coarse snakestone, using a sponge and water freely. Then stop the surface with gauged stuff, and when it is firm remove the superfluous material with a scraper. This stoning and stopping are repeated, and then the surface is stoned with a fine snakestone. The work is allowed to dry, and finely polished with a fine snakestone, water, and soft rags. This is the process used in the only London shops where Scagliola is made. Wax must not be used, as it would discolour a pure white plastic surface.

Manufacture of Incandescent Mantles.—Considerable difficulty has been experienced in obtaining detailed information regarding the material, etc., used for incandescent mantles. Each manufacturer has different methods, and tries to keep these as secret as possible. One firm that supplies all materials charges a fee of £20 for complete instructions; this does not include the formula of collodion. The thread used may be cotton, Egyptiau spun cotton, China grass, or ramie; the latter is made from the fibre of an Indian thistle. One manufacturer uses artificial silk made in Belgium. The diameter of the thread varies from \$\frac{1}{2}\sigma\text{in}

to ensure evenness of the light-giving fluid and to remove any superfluous liquid, then put on glass moulds to dry. The tops are next dipped in a fixing liquid to strengthen the part through which the ashestos string will be put. The mantles, when dry, are hurned off first with a fiame under ordinary pressure, and then with a fiame under a pressure of from 5 lb. to 7 lb. per square inch. They are then dipped in a toughening mixture of collodion, ether, and alcohol; the air of the room in which this operation is carried ou requires frequent changing. Drying is done at a temperature of 120°F; the air of this chamber being highly inflammable, containing ether and alcohol vapours, also requires frequent changing. The hottoms of the mantles are next trimmed with scissors when in the boxes.

Equal Division of Triangular Piece of Land.—By the method described below and illustrated by the figure, any triangle may be divided into three equal parts by lines parallel to any of its sides: Let Λ BC be the triangle to be trisected. 1. Trisect each of the sides in a a' a''. 2. Upon each side describe a semicircle. 3. From the points of trisection a a' a'' erect perpendicular triangles of the side of the sides of the side of the sides of



Equal Division of Triangular Piece of Land.

diculars to meet the semicircles. 4. With B as centre and $Bb\ Bb$ respectively as radii, describe arcs cutting the side AB of the triangle in cc. 5. Lines drawn from cc parallel to Ac will divide the triangle into three parts of equal area. In a similar manner, as may be seen from the illustration, lines dividing the triangle into three equal parts may be drawn parallel to the other sides. Similarly, any triangle may be divided into any number of equal parts.

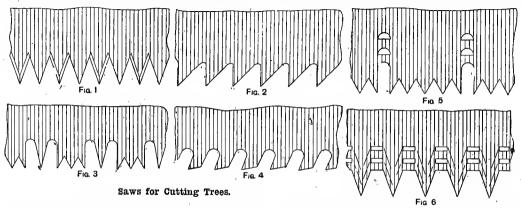
Celluloid Manufacture.—In making celluloid the first operation is the preparation of a nitrated cotton, which is similar to gun-cotton. Two parts of strong sulphurte acid are mixed with I part of concentrated nitric acid in a shallow stoneware vat. The cotton or tissue paper is weighed out into small perforated jars, each provided with a lid, and when the temperature of the acids is 60°C, the jars are placed in the acid, which penetrates through the perforations to the cotton. After about forty-five minutes the jars are removed and placed in a vat of water, and fresh water is rnn through the vat to wash out the acid, the last traces being removed by a little ammonia or carbonate of soda. The nitrated cotton is next dried at a low temperature, and is mixed with camphor and spirit of wine or with acetone, which will soften it. The mass is then kneaded and pressed into square blocks. Moulded articles are made from the plastic celluloid, but some articles are cut or turned from the solid. The celluloid soon hardens in contact with air owing to the loss of the solvent. As a rule, a little castor oil is mixed with the celluloid to make it more flexible.

Removing Transfers from Cycles.—Provided the enamel has been stoved and is hard, rub the transfers very lightly and evenly with powdered pumice and water applied with a rag. When most of the transfer is removed (that is, when the surface of the enamel is nearly reached) wipe off with clean water and with a clean rag and powdered rottenstone and water. Repeat the process, rubbing harder till all trace of the transfer is removed. Then clean off again and polish, to restore the lustre of the enamel. This is the most difficult part, and is done with powdered rottenstone and water, using the bare clean hand. The cleaner and softer the hand, the better the result.

Saws for Cutting Trees.—The peg-tooth crosscut saw (Fig. 1) is undoubtedly one of the best crosscuts if it is kept sharp and the teeth are not allowed to become short and stumpy. The varied grain, at the foot of a tree with a flaring butt, is not usually so important a matter as to warrant a change of saws. But if a change is deemed necessary, the saw shown at Fig. 4 will be the best substitute. This saw is equally effective for long-or cross-grain work, but, of course, it cuts only in one direction. This throws most of the work to one end, and necessitates an occasional change of ends between the operators. There is a strong tendency for the saw to "hook" or dig deeply into the wood, and hlock, when it is used by inexperienced hands; but where the operators are accustomed to each other, and to the type of saw, full advantage is taken of this tendency to hook, the back

and citric acids. To remove violet stampings, try bleaching with chloride of lime. Make a saturated solution of this and apply as directed before, and place the engravings in the sun, afterwards washing with water and neutralising with ammonia. Another method is the application of zinc grey, the zinc of which reduces the colour and forms a colourless compound. Make a paste of 100 parts of zinc grey, 20 parts of mucilage (any gum will do), and 20 parts of hyposulphite of soda; apply this paste and let it dry, afterwards sponging off with hydrochloric acid. Try the effect on a corner first, as papers differ in composition, some being destroyed under such treatment. Alcohol acidulated with nitric acid may also be tried.

Acetylene Table Lamp.—An acetylene table lamp mustof necessity have two bad qualities: (1) delivering an impure gas at the hurner; (2) having no certain means of preventing generation of gas and its escape, after the light is extinguished. The water should attack the carbide from below, and so save deterioration of the carbide as far as possible, If there is a tap to the burner the light can be extinguished, but this tap does not prevent "after-generation." This is the continued generation of acetylene for a little time after the light is extinguished and the water supply shut off. In a residence lighting plant there always appears a telescopic gas-holder, and this accommodates the gas of aftergeneration; but with a portable lamp such a holder is earcely possible, and any gas made after the light is



man "entering" at the right moment to work out all the momentum that is put into the saw at the beginning of each stroke. Figs. 2, 3, and 5 are types of saws that come hetween the peg-tooth and that last described. Fig. 2 is common in timber yards, and is generally machine sharpened. It is mostly used for cross-cutting soft wood, is set wide, and is used lightly. Figs. 3 and 5 are examples of Dieston's "Nonpareil" saws, in which extra deep gullets occur at intervals. These are known as "cleaner teeth." They make the saw very free working, and also sharpen the pitch. Figs. 5 and 6 both show blank gulletings for future deepening as the saws wear. In Fig. 6, which is made by Dominicus & Son, of Remscheid (in Prussia), guiding lines are also inscribed, with a view to ensuring symmetrical teeth when the saws are hand sharpened.

Removing Stains from Engravings.—To remove stains of mildew or aniline from prints and engravings, a great many recipes could be given, but none of them is quite successful, simply because such stains are more or less indelible; of course, when they are of long standing, the difficulty is increased. For mildew or damp, try the following: Place the engraving on a clean surface, such as a glass plate, and, working one spot at a time, with a camel-hair pencil apply water until the spot is well damped through. Then on it put a little powdered oxalic acid; this acid is sold in crystals, which must be rubbed down into a powder. Then, if possible, put the engraving out into the sun to bleach and dry. If the stain does not yield to this treatment, it is hopeless to proceed further, but, of course, several applications may be given. The acid should afterwards be well washed out, the engraving being placed on blotting-paper and water applied freely to the spot. Soak up the water with blotting-paper, and always shift about the blotting-paper underneath. Any acid left in may be neutralised by applying a weak solution of ammonia or hyposulphite of soda, and again washing with water. A milder treatment is sponging with chemist's salts of lemon, which is equal parts of tartaric

extinguished has to blow off from a valve provided in the lamp if the gas is not burned. The Act of Parliament makes the valve necessary, as acetylene may not be made at a pressure exceeding 100 in. of water. A table lamp is best without a cock to the hurner, and it should be allowed to burn out the gas of after generation which comes after the water valve is closed. Another use of the gas-holder in large plants is that no one can make acetylene in the precise quantity that the hurners use. If too little acetylene is generated the light fails. If too much is made the holder stores this, but a table lamp, having no adjustable holder, has to discharge the gas through a valve. It is therefore possible to have free acetylene discharging when the lamp is burning in the ordinary way. The majority of engineers consider that the gas should first be washed by passing it through water, and it should then be cooled and passed slowly through a chemical purifying agent. These things, while quite simply obtained in a large plant, are next to impossible in a portable lamp. With a vehicle lamp a smell of escaping unburnt gas and a smell from the burned impure gas are no faults, as they occur in the open air, but such smells are prejudicial to a table lamp.

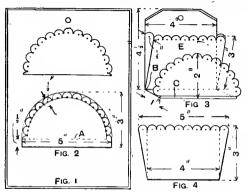
Reinking Tynewriter Ribbons.— Tynewriter rib.

Re-inking Typewriter Ribbons. — Typewriter ribbons, etc., can be cleaned by soaking in methylated spirit. Newink may be applied by a machine constructed as follows. A small base of wood has fitted to it two uprights, in each of which two holes are bored; in these holes two small wood rollers with steel pins at each end are fitted so that they nearly touch, but before fitting the lower roller is covered with flannel. To one roller a handle is fitted, by turning which hoth rollers revolve; the whole device is similar to a toy mangle. A slab of marble or wood is covered thickly with the ink and placed below the lower roller in contact with the flannel, which will pick up the ink. The flannel should be saturated with the ink. The ribbon may then be run through, and will take off, just sufficient ink. The ribbons should be ironed out flat before heing run through (see also Series I., p. 307, and Series II., p. 50).

Making Tube Gongs.—Tubular gongs or bells are made of solid-drawn tubing, either of brass, steel, or a special alloy. Starting with a length of 2 ft. 6 in. for the lowest note, the tubes will each be shortened about 1½ in. to 1 in. as the scale rises, the higher notes not requiring so much shortening in proportion as the lower ones. The exact lengths cannot be given, as they vary somewhat according to the quality and composition of the tubes, but care should be taken to cut them long enough, as when tuning it is impossible to lengthen them. A good round tone should be obtained by having the longest tube about ½ in. in thickness. The best striking place will be about one-third the length from the top, and the gongs should be suspended by thin cords made of cotton or silk.

silk.

Letter-rack and Match-holder in Tinplats.—
The following describes briefly how to make two
very useful articles. For the letter-rack (Fig. 1), from a
sheet of thin tinplate (common charcoal) cut a piece 10 in,
by 7in., mark off a narrow edge as shown (k in. being
sufficient), notch the corners, and turn down the edge
all round, flattening it and finishing it quite smooth.
Next cut out three pieces (Fig. 2), the small semicircles
being marked out with compasses. Punch 3: in. holes
all round as indicated by dots, and turn down square
on the dotted line A. Then solder the pieces to the
hack at equal distances apart, and punch a hole at
the top for hanging up, finishing by enamelling any
suitable colour. To make the matchbox and spillholder (Fig. 3), first cut out a piece of tinplate 5; in.
by 4in., and set it off to the dimensions given. Turn



Letter-rack and Match-holder in Tinplate.

down smooth, narrow edges at the top, turn up the sides square at B, and also turn up 1-in. edge at C. Next make the pocket E as shown in Fig. 4, turning it down square on the dotted lines. Solder it in position, cut out the front to dimensions given in Fig. 3, and solder it to narrow edge C. Punch a hole at the top for hanging, and enamel the article. These two things look very well if enamelied pale blue, and the narrow edges and "scalloped" parts are touched off with gold.

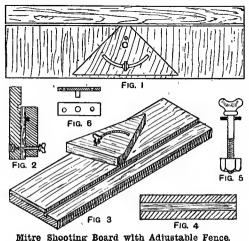
if enamelled pale blue, and the narrow edges and "scalloped" parts are touched off with gold.

Painting Moonlight Scene for Stage.—To paint a moonlight scene for theatricals, celestial blue, indigo, black, vandyke brown, emerald green, and whiting will be required. If difficulty is experienced in obtaining the indigo, the celestial blue may be saddened with a little indigo, the celestial blue may be saddened with a little hlack. First mix each of the colours into a paste with a little water. Assuming the canvas is primed ready for painting, draw the circle for the moon, which will be cut out after the sky and scene are finished and dry. Mix a little celestial blue with the white and commence to paint round the moon, gradually extending the circle, adding more blue as the brush recedes from the moon; also add a little indigo to the far distant sky. Paint in the clouds, using the same colours, but adding more indigo or black in the darkest parts of the clouds for the high lights of the clouds use emerald green and white. Lay in the distant mountains directly under the light of the moon with the sky colours, all the high lights being put in with the green and white, strengthened with more emerald green as the distance away from the light of the moon is increased. To the right and left of the scene use a little vandyke brown in juxtaposition with the blues so as not to mix the colours, or they will become like mud. Keep adding the darker colours towards the foreground and distant parts. Those parts to a pair of compasses strike the circle

of the moon catches the edge of the clouds, make some cuts with the point of the knife through the cloth; the cuts must not be too long or they will gape open too much. For the moon, get a piece of white union or glazed calico 3in. or 4in. larger than the circle. Lay the scene flat down on the floor or table; brush some liquid glue round the circle, taking care that the glue does not flow under the cloth or the sky will be spoilt. Lay the square of calico even and flat down, and on it place a piece of board with a heavy weight until dry. To light the moon have as much light as possible, taking care that the jet is not seen through the moon. For a dark cloud across the moon, paint in with very dark colour. colour.

colour.

Mitre Shooting Board with Adjustable Fence.—A mitreshooting board that can be adjusted to make mitres of any angle, and also butt or square joints, is shown in plan and section by Figs. 1 and 2, and in isometric projection by Fig. 3. It consists of a bed 1½ in. thick, 91n. wide, and 2ft. 6in. long; this has a ½-1n. groove 2½ inc. from the front edge, and to the top is fixed a cover piece ½ in. thick, slightly overlapping the groove, as shown in Fig. 2. This cover piece forms the rebate in which the trying plane works, and should be planed perfectly true and of uniform thickness; it must be firmly fixed to the hed with glue and screws, and would be better if laid in bed with glue and screws, and would be better if laid in



Mitre Shooting Board with Adjustable Fence

short lengths with the grain running across the bed as shown in Fig. 1. The fence is formed of a triangular piece of beech or hard mahogany 13 in. long and 6 in. wide, with its working sides cut at angles of 45° with the front, and should be built up in three thicknesses well glued together, with the grain crossing, as shown in Fig. 4. This fence is mounted on a pivot at C, and has a quadrant slot cut through it nearly to its edges. This slot must be struck out from the pivot as a centre. Opposite the pivot in the under back edge of the bed is sunk a stout nut as shown in Fig. 2; Fig. 5 shows an enlarged view of the nut. A ½-in. thumbscrew, passing through the quadrant slot, engages with this nut and locks the fence in any desired position. A large washer should be used on the thumbscrew to prevent the head burying itself in the wood. An ordinary sash pivot plate may be utilised for the pivot, as shown in Fig. 6, the stud portion being fixed in the bed, and the socket plate in the under side of the fence. Fig. 1 shows the fence set to cut an ordinary right angle mitre, and each side may be used without alteration. Fig. 3 shows the near side set for a very obtuse angle, and the other side would require to be reset to the same angle to shoot the mitre on the corresponding piece of moulding. The correct mitre would have to be found by bisecting the angle of the frame and setting a bevel to it; this would give the angle for the fence when the stock of the bevel is applied to the edge of the rebate in the shoot.

Cleaning Plushette.—Plushette is a woollen pile the shoot and the stock of the very seldom

applied to the edge of the relate in the shoot.

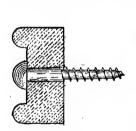
Cleaning Plushette.—Plushette is a woollen pile fabric, usually very coarse in texture and very seldom fact dyed. Owing to this last named fact, any wet process of cleaning will discharge the colour. The drycleaning method is satisfactory, but for this expensive plant will be necessary. The material can be washed with weak soapsuds in the ordinary way, and re-dyed with any darker shade than the original colour. The only method of dry cleaning that can be advised for home purposes is sprinkling with hot bran, and well brushing out with a soft bristle brush.

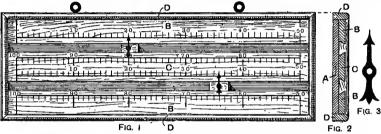
Analysing Epsom Salts.—Epsom salt crystals consist of sulphate of magnesium with a large quantity of water of crystallisation. There are, therefore, three things to determine: (1) Magnesium, (2) sulphuric acid, (3) water. For the estimation of magnesium and sulphuric acid, welfs out accurately 5 grammes of the salt, dissolve it in distilled water, and make up to 500 c.c. Take 50 c.c. of this solution in a beaker, add a solution of ammonium chloride and ammonia until it smells strongly, and then a solution of sodium phosphate, and allow to stand; in the morning filter, collect svery trace of the crystalline precipitate on the filter paper, wash thoroughly with water containing ammonia until free from salts, then dry, and ignite the precipitate in a weighed porcelain crucible. The ignited precipitate consists of magnesium pyrophosphate, and must be calculated to magnesium by multiplying by the factor his as 50 c.c. were taken, this equals i gramme of original Epsom salts; therefore to calculate to percentage multiply the weight of the magnesium, obtained as above, by 200. Now take another 50 c.c., add a little dilute hydrochloric acid, and boil; while boiling add a solution of barium chloride until the precipitate cases to form. Collect the precipitate on a filter paper, and wash with hot water till free from chlorides, then dry and ignite in a platinum crucible. The precipitate is barium sulphate; it is calculated to sulphuric acid by multiplying by 200. The water is determined by weighing I gramme of Epsom salts into a crucible, gently igniting with the lid on, cooling, and again weighing. In the above determinations of magnesium and sulphuric acid the ash of the filter paper is to be deducted.

Simple Wall Protector.—To protect walls that are painted, papered, or stained, from being marked or bruised by the contact of chair backs, the device illus-

bridge pin and round the hitch pin, and return to the next wrest pin. Then with pliers cut the wire about 3 in. above the pin, insert it in the hole, and coil it round. When the wires are required with a separate loop to fasten on the hitch pin, a simple method to adopt is to form a loop by bending the loose end of the wire several times round the long length, and then leave about 1 in, which should be turned back at right angles to the other portion. The loop when put on the hitch pin will adapt itself as the wire is tightened up, but will not slip as long as the short right-angle section presses against the iron frame plate or bent side. If new wrest plns are used it will be found that the coils of new wire round them stand much in front of those round the old pins, and, as constant turning of the pins would simply add more coils, the pins are left with three coils on, and then driven home by a sharp blow with a hammer. But careful examination must be taken for any signs of splitting, and should there be any apparent danger from this treatment, the pins must be turned nearly home before the wires are added. New wire is sold in 1-lb. rings and is easily obtainable.

Register for Table Tennis.—For making the register for table tennis illustrated at Fig. 1, the material may be walnut or mahogany; a piece of fretwood 1½ in. long, 10 in. wide, and ½ in. thick will he required. Cut from it for the base, A, an oblong piece 13 in. by ¼ in., and one c, 13 in. by ½ in., and one c, 13 in. by ½ in. Bevel the edge on one side only of the two pieces B, and bevel both the edges on the other piece. Then screw the 1-in. pieces flat on the top and bottom of the baseboard (see Fig. 2), and the 1½-in. piece in the centre of the baseboard, putting in the screws from the back. The bevelled edges form two spaces, the narrow parts measuring ½ in., and in these small pieces slide, these pieces also having both edges bevelled. Either





Simple Wall Protector.

Register for Table Tennis.

trated herewith may be used. Procure some indiarubber buffers, as sold by rubber merchants, and some round-headed screws, and fasten the buffer to the part of the chair back that first comes in contact with the wall, as shown in the illustration. If the chair back has much curvature, only one buffer is required, but if the chair is only slightly curved or flat, two buffers may have to be used.

Piano Not Standing in Tune.—In a case where the two middle octaves of a piano do not staud in tune, larger wreat pins may be tried; if these are not satisfactory, it would be well to examine the wreat plank into which the tuning pins are inserted for signs of splitting, or to see whether the holes have assumed an oval shape by reason of the downward pull on the pins. If the plank is free from these defects, try driving the pins further home, giving them sharp hlows with a fairly heavy hammer. If the holes in the plank are too with glasspaper, putting the rough side against the wood, or line the hole with thin veneer. If the plank is split, larger pins, or lining the hole, will only make matters worse, and repair or renewal of the plank is the only satisfactory remedy. Larger pins can be bought in several sizes, but are supplied in complete sets only. New steel wire will also be required; therefore search amongst the pins for the sizes, probably from Nos. 12 to 22; these give the music wire gauge sizes of the wires the right of them, and if they cannot be discovered a M.W. gauge will be required, or short sections of the wires may be sent when ordering. To replace with new wire, uncoil the old wires by turning back or entirely removing the pin, and select a new wire of the exact size required. Handle the wire as little as possible; in fact, persons subject to moist hands should wear an old pair of gloves. Draw out from the coil about as much wire as is necessary, push the end through the eye in the wrest pin, turn the hammer until there are three coils around the pin, pass the wire down, fitting it against the

paint figures on the boards, or paste on them printed slips with figures up to 100 and divided into spaces as in Fig. 1. Then with a fretsaw cut from sheet brass two pointers (Fig. 3), and screw these on the small sliding pieces with round-headed screws, placing a washer underneath each pointer, so that it can be turned round to point at figures both at the top and bottom. To complete the board and to secure the sliding pieces, cut from the ½-in, stuff three strips D (Fig. 1), 14 in. by ½-in., with rounded edges, and it is easier to round a length before cutting off the pieces. One of the strips should be cut in two, and the four strips nailed round the edge of the register. To make neat joints at the corners, they should be mitred, and the register is then ready for French polishing or varnishing, as desired. Screw in two picture rings at the top, or use the ordinary wall-plates, and by means of these the register can be hung on the wall for use.

Removing Blood Stains from Parchment.—In the manufacture of the finer classes of leather (such as calf for bookbinders, and various skins for glove-makers) and parchment or veilum, after the unhairing process, and before dressing, the skins are subjected to a hath of dog's putrid dung mixed with tepid water. This mixture is said to remove all fat, grease, and other stains. Mannfacturers have tried to find a substitute for this unpleasant mixture, but have not succeeded. It is thought that the bacteria created by the putrefaction has some special effect not to be otherwise obtained. The following may also be tried: Immerse the parchment in a solution of a cetic acid and gently rub the stained parts while wet with Inmp pumice on a flat board, then bleach with chloride of lime. This is said to render the parchment white enough for bookbinding purposes. The parchment may also be subjected to a bath of salt of lemons (equal parts of citric acid and cream of tartar). These acids may have on the parchment a hardening effect which is of course detrimental, so caution must be observed in their use.

Greasy Appearance of Plano Front.—On the front panels of a rosewood piano there may be a permanent sueary appearance, a kind of sweat working through the polish. This trouble is more frequently met on rosewood goods than on any other kind, and it may be due to several causes, such as indifferent work in the early stages of polishing, owing to the coarse, open grain of the wood, or Russian tallow may have been used as a grain filler, or in the effort to gain a solid foundation excess of oil may have been used with the polish. This grease or oil must he absorbed somewhere, and as the glue underneath the veneer will not let it go in that direction, it breaks through the film of lac, called polish. The annoyance is greatest in hot weather, or when the instrument is kept in a warm room. The trouble is difficult to cure except by repolishing, and even this must he done two or three times. The grease, as it shows itself, should be cleared off with a soft rag slightly damp with benzoline, or even rain-water in which a small piece of common washing soda has been dissolved. Freshen up again with a mixture of raw linseed oil and vinegar—equal parts of each—and polish up to a good lustre with a silk handkerchief slightly damp, no twet, with methylated spirit or with whiskey; apply the handkerchief lightly at first, exerting slight pressure as the spirit dries out.

Inches and Fractions Expressed in Decimals.—The accompanying table of inches and fractions ex-

letters and allowed to run off. This operation requires great care or the gold will be washed away, especially if the size is too weak. The line of gold that is wanted must be painted in with a backing of gold-size or varnish and red-lead; when hard the gold beyond the edge of the line can be easily washed off. The inner part of the letter can be written in with pale varnish, and when almost dry can be gilded; this will appear duil to the gold edge done with isinglass. Another method is to write the letters in with a weak solution of white matting acid; this roughens the surface of the glass. The letters are then gilded with the isinglass size, the gold being brought beyond the letters in order to allow the bright line round margin to be obtained, and the whole of the letters, centre, and edges are written in with the japan gold-size and red-lead. When dry the gold not wanted is removed with water. Any backing that does not contain moisture can be used for preserving gold placed on glass. Varnish, japan gold-size, Brunswick black and coachmakers' black japan, are all used as protective backings.

Making Large Quantity of Silver-plating Solution.—A useful silver-plating solution can be made with 3 oz. of silver in each gallon of solution; so that for 150 gal. 450 oz. of silver will be required. As there are 108 oz. of metallic silver in 170 oz. of silver nitrate, 45 lb. avoirdupois of silver nitrate will be required, and about 30 lb. or more of best grey potassium cyanide, to

| | Inches:- | 0 | 1 | 2 | 8 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--|--|--|---|---|--|--|--|--|--|--|--|--|---|
| Decimals of unity, or an inch. | Fractions of an inch (parts) | Foot. | Foot. | Foot. | Foot. | Foot. | Foot. | Foot. | Foot. | Foot. | Foot. | Font. | Foot |
| 0825 1250 1875 25 3125 3750 4375 5625 6250 6875 75 5125 5750 | To de contrat of 17:30 75 of 15 do 15 do 170 do 170 fe of 170 fe o | **005208 **010416 **0116625 **020833 **028041 **03125 **036458 **04166 **046875 **052083 **052081 **06250 **067708 **072916 **073125 | 083 088 094 099 104 109 114 120 125 130 125 146 151 156 161 | 166 172 177 182 187 198 198 208 213 219 224 229 234 239 245 | *250 *255 *260 *265 *271 *276 *281 *286 *291 *297 *302 *307 *312 *318 *328 | *333 *338 *344 *354 *351 *359 *364 *371 *375 *380 *385 *390 *396 *401 *406 *411 | *416 *422 *427 *432 *433 *443 *453 *453 *458 *463 *474 *479 *484 *489 *494 | *500 *505 *510 *515 *520 *526 *531 *536 *541 *547 *552 *557 *562 *578 | *583 *584 *594 *694 *604 *620 *625 *630 *646 *646 *651 *656 *661 | *666 *671 *677 *682 *687 *692 *697 *708 *713 *718 *723 *729 *734 *734 *734 | 750 760 765 765 771 776 781 786 791 797 802 807 812 818 823 828 | *833 *844 *849 *854 *859 *864 *870 *875 *880 *885 *890 *895 *901 *911 | 916 922 927 932 933 948 958 969 971 974 974 979 984 |

Note.—The first column gives the decimals corresponding to the fractional parts of units in the next column; thus:—

1876 of an inch is 1875 of an inch. The remaining columns give the decimals of a foot corresponding to inches and parts; thus:—53 inches is 448 of a foot, and 13 inches is 004 of a foot.

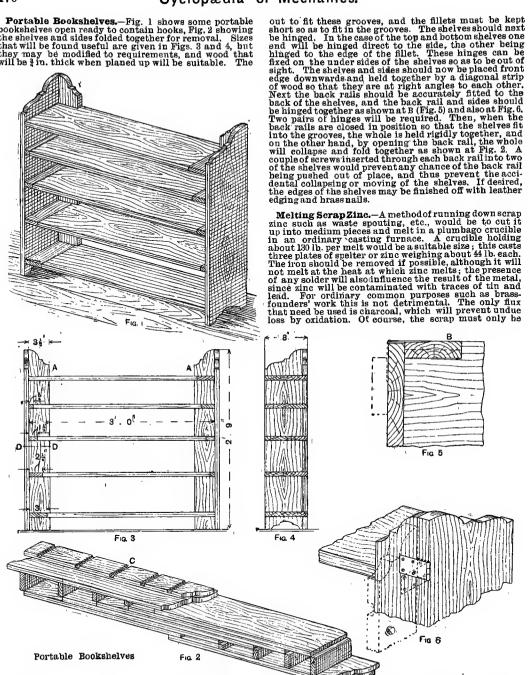
pressed in decimals will, it is thought, be found valuable by those who have a practical interest in plumbing, building construction, masonry, and sanitary eugineering, etc.

Gilding on Glass.—Below is described how to write a sign on glass, each letter to be outlined with a burnished line \$\frac{1}{1} in wide, the interior of the letter being in a duller gold. The glass should, if possible, be taken out of the sash or frame and laid flat on a table. The parts of the letters that are to be in dull gold should be left plain glas; and the rest of the plate coated with embossing black. The portion of the glass that is not covered with the black is then eaten away with hydrofluoric acid, the acid attacking only the exposed portions of the glass. The time required for the acid to do its work (from a few minutes to half an hour) depends on the strength of the sofution. The depth to which the acid has bitten may be ascertained by drawing a fine bradawl or needle against the edge of the letter. When the letter is deep enough, the acid is removed by washing with water, and the black is removed with turpentine. The letters are alterwards gilded, the gold leaf being allowed to come heyond the edge of the letters to the required width of the burnished line; a weak solution of isinglass can be used as a medium. The gold line when dry is protected by a coating of red-lead and gold-eize, and when this is hard the snrplus gold is easily washed off. If the plate glass cannot be removed from its perpendicular position, the acid cannot be used in this manner. The letters must be carefully written on the face of the glass, and the gold laid round the edge of the letters on the back, on a weak solution of isinglass. The gold is cut on a cushion, and placed on the wet size. When this is dry, the gilding will appear bright from the face side; if the gold is not sufficiently bright, it may be further hurnished with hot water, which is rapidly poured on the

convert the silver nitrate iuto the double cyanide of silver and potassium. About 230 gal. of distilled water will also be required. First well wash the plating vat and carefully sponge out all dirty water, then half fill the vat with distilled water. Next half fill a large stone-ware or earthenware pan with distilled water and dissolve therein some of the silver nitrate in the proportion of 1 lb. of the silver salt to each gallon of water. Stir with a glass or clean wood rod until all the silver crystals are dissolved. Then dissolve some of the potassium cyanide in distilled water, in the proportion of \$\frac{1}{2}\$ lb. to \$\frac{1}{2}\$ gal., and add this carefully, whilst stirring, to the silver nitrate solution, as long as it causes white curds or clouds. Now allow all to settle, carefully pour off all the water, and throw this away. Then pour on fresh spring water to wash the silver curds well, and pour all this water away. Next dissolve all the curds in a strong solution of potassium cyanide, and pour this solution into the plating vat through a calico filter. Proceed thus until all has been prepared and added to the first lot in the plating vat. Then add 5 lb. more of potassium cyanide, previously dissolved, to form free cyanide. The voltage necessary to work this solution is from four to five volts. The current in ampères is in proportion to the surface of goods immersed in the solution at any one time, so may range from 1 to 100 ampères. The safe rate is found by experience, and varies with the character of the work in hand. For other notes on silver-plating solutions, see Series I., pages 152, 233, 243, and 300.

Melting Sulphur.—For melting sulphur obtain an earthenware crucible (this may be purchased for a few pence from a dealer in chemical apparatus), place in it a piece of roll sulphur, and put the crucible on a clear fire. In a very short time the sulphur will melt; the crucible should then he removed hy means of a pair of tougs.

Portable Bookshelves.—Fig. 1 shows some portable bookshelves open ready to contain hooks, Fig. 2 showing the shelves and sides folded together for removal. Sizes that will be found useful are given in Figs. 3 and 4, but they may be modified to requirements, and wood that will be 3 in, thick when planed up will be suitable. The



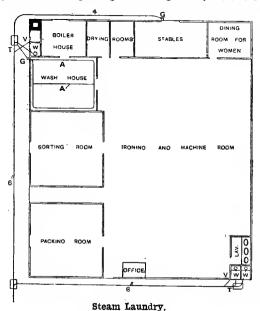
following points in the construction deserve special mention. Planethe several pieces of wood to dimensions, and curve the side and back rails A (Fig. 3) at the top and bottom. All the shelves are of exactly the same length, but at one end of the top and bottom shelves, and at each end of the three intermediate shelves, are fillets, these varying in breadth as indicated in Fig. 3. The sides should be grooved to receive these fillets so that they may be firmly secured by glue and the insertion of a few fine screws, but the left-hand side will not require grooving for the top shelf nor the right-hand side for the bottom shelf. The back rails as C (Fig. 2) have grooves formed in them, the depth of which is half the thickness of the wood. The backs of the shelves must be notched

heated to the melting point of the metal, or a very considerable loss will ensue, due to volatilisation. When the metal is melted at the bottom of the crucible, add zine scrap from time to time till the crucible is full. Then stir, withdraw from the furnace, skim well, and pour into the moulds. If the metal is just kept to melting point only, and general impurities such as lead, tin, and iron are also absent, the fracture of the cast slabs will be uniform. Slight quantities of other metals alter the fracture very considerably.

Nut Butter.—This is made from cocoanuts hy pressure and after treatment to remove the smell and taste. An hydraulic press and other plant are required.

Tools Required for Watch Repairing.—The following is a list of what are, perhaps, the most necessary tools, but a watchmaker cannot have too many. For turning, a pair of turns with accessories, gravers, and arbors, or else a watch lathe; a parallel vice with 2.1n. jaws. round, square, and triangular files from the smallest sizes made, also flat files and flat and oval burnishers, small and large pilers, cutting nippers, a pair of sliding-tongs, pin-vice, hammer, jewel screwdriver, medium and large screwdrivers, a watch movement holder, benzine pot, watch brush, sets of drills and drill stocks, chamfering tools, screw plate, and taps.

Steam Laundry.—The diagram shows the ground floor plan of a steam laundry. The arrangement, it will be seen, comprises a large ironing and machine room, packing and sorting rooms, wash house, boiler hone, two drying rooms, dining room for women, stabling, and office, Lavatory accommodation, and three water-closets with external entrances, are also provided. The drainage system consists of 6 in. socketed pipes trapped at T, with three inspection chambers, and connected to gulliss G with 4 in. socketed pipes, ventilators being fixed at V. The floor of the wash-house has a half-round channel with lion grating A, emptying on to the gully. If desired, the partitions of the packing and sorting rooms, also of the



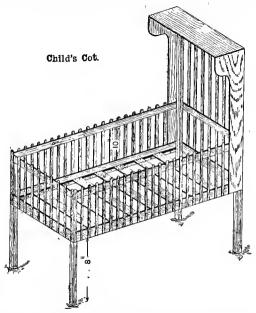
wash-house away from the boiler-house, need not be carried to the roof, but to a height of about \$\frac{1}{2}\$ft. 6 in. By this means a complete view of the workrooms is obtained. The three rooms should then be connected by means of gangways. The external walls of the building are of brick, the internal partitions generally being of wood. The building has an ordinary span roof, and ample light for the workrooms is afforded by glazing the top part of the roof. The illustration is reproduced to the scale of \$\frac{1}{2}\$ in. to the foot.

Cleaning Buckskin Boots.—Below are instructions on renovating a pair of dirty buckskin boots. If proper wooden boot trees are not available, the boots should be treed up as tightly as possible with pieces of paper; then with a soft brush and soap and water well wash the boots all over, to remove as many of the stains as possible, then rinse them to wash out the soap, but do not sodden them more than can he helped. Allow the boots to get half dry, then give them one or two coats of wet Blanco; or if pipeclay is used, squeeze with it a very little blue from the blue bag. Each of these preparations should be made about as thick as cream. Brush it well in, and put it on evenly, so that it does not cake, yet covers all the stains. When the boots are quite dry rough up with fine sandpaper, pressing very lightly and in a circular direction. Now remove the boots from the trees, rub them about to soften the leather, then rub them all over with ordinary plain chalk applied on a piece of grey boxcloth or a piece of stale bread, and then brush off all the surplus stuff very gently. The above method is very handy for shopkeepers, whose stock

of buckskin boots often gets dirty, but in their case the boots should only be just damped over with a sponge, and not wetted thoroughly.

Removing Varnish from Photographic Negative.—Place the negative in a clean flat dish which must be quite dry, and pour over the negative about 10 oz. of methylated spirit. Cover the dish with a sheet of glass in order to restrain evaporation, and allow to stand for a few hours, then rub the negative over with a clean tuft of cotton wool. If the varnish still adheres in streaks, return the negative to the dish for a little while longer. The film of the negative may be polished with a clean soft rag.

Child's Cot.—The illustration given below shows a cheap and easily constructed cot. In putting this together, the sides and ends are first made complete with the bars, and fastened with l½-ln. screws on to the legs, which are of pitch-pine l½ in. square. The length and breadth, outside to outside of legs, is 4ft. 2in. and 2ft. respectively. The side rails are 4ft. 3in. long hy 3in. deep by ½ in. thick, and have 10 in. space between them. The end rails are 2ft. long by 3 in. deep by ½ in. thick. The bars are of ½ in. stuff, 1½ in. wide, and 1ft. 5 in. long over all, and show l in. above the top rail. They are spaced about l½in., and are fastened with ½-in. brass rivets into the

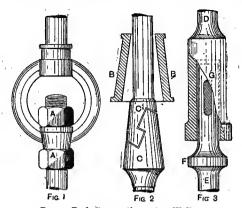


hardwood rails. The top edge of the top rail is 3ft from the floor, and the extreme height of the head piece is 4ft, the width of the head piece being 6in. The bottom of the cot is formed of ½in. spruce battens, 4in. wide, and spaced 2in. spart, these being nailed to a batten line deep by ‡in. thick, which is screwed on to the lower edge of the bottom rail. This gives 1ft. 3½in. clear depth inside the cot. All the sharp edges and corners inside should be rounded off, and if fancy timber is used, the cot looks well when varnished.

Painting Oak.—In painting oak a good dark green colour, if a box is new, rub it down well with No. I glasspaper to remove any inequalities. Then apply a coat of lead-colour priming paint, made from genuine white-lead and a little black paint mixed with equal parts of raw and boiled oil, and with a little turpentine and driers. When the coat is thoroughly hard, rub lightly over with No. 0 glasspaper, dust off, and apply another coat of paint, to which has been added a small quantity of deep green. Next obtain about 21b. of coach green ground in turpentine and a little lemon chrome paint, and add the chrome to the green until the desired shade of colour is obtained. Thin the paint ready for use with 3 parts of turpentine and 1 part of boiled oil, and apply two thin coats, rub lightly over with No. 0 sandpaper, dust well, and apply a coat of outside copal oak or carriage varnish, and when dry run a yellow band in with a coach-painter's sable liner brush, using lemon chrome paint thinned with turpentine. After this has thoroughly dried, apply a finishing coat of elastic carriage or body varnish.

Petroleum Jelly and Vaseline.—Petroleum jelly is prepared by dissolving paraffin wax in a pure heavy mineral lubricating oil. For this purpose about 5 parts of oil are heated in a pan, and l part of paraffin wax is stirred in until it dissolves. Vaseline is an entirely different product. When natural crude petroleum is distilled it yields a series of gaseous, liquid, and solid hydrocarbons having very nearly the same composition but very different properties. Marsh gas, contained in ordinary coal gas, is the lowest member of this series, and the solid paraffin waxes are the higher; the internediate products are mineral lubricating oils and vaseline. Vaseline is a homogeneous substance from which no other substance can be obtained; it is to all intents and purposes a pure compound, and cannot be obtained except by the careful distillation of the crude petroleum on a large scale. Another note on making vaseline appears in Series I., p. 211, and the process of petroleum distillation is described in Series II., p. 229.

Pump Rod Connections for Wells.—Three joints usually employed for pump rod connections are shown by the illustrations. Fig. 1 shows an adjustable joint often used to connect the well rods to the bucket rod, the nuts A allowing for the regulation of the travel of the bucket in the working cylinder. Fig. 2 is an elevation of a very eimple and strong joint, which, when well fitted, cannot get out of order. B is a brass socket which



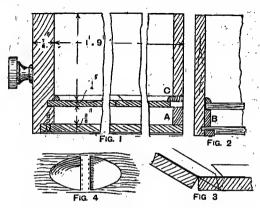
Pump Rod Connections for Wells.

fits over the cone C; half the cone is on the top rod and the other half on the bottom rod. The cone is dove-tailed as shown, forming one solid cone. The socket B is shown slipped up, exposing the method of dovetailing. Fig. 3 is a cottered joint shown partly in section, D being the top rod with a sleeve, E the bottom rod which slips into the sleeve, as shown, and G the cotter. On the bottom rod a collar F is provided which facilitates the disengagement of the parts after they have been in use for some time. The cotter having been knocked out, wedges can be driven between the collar and the socket to force them apart. to force them apart.

Sharpening Shoemakers' Knives.—The following is advice as to the best method of sharpening a shoemaker's knife whose edge has roughened and broken away. Take the emery stick, seeing that the emery is put on quite flat, and lay the knife on flat for about three-eighths its length and rub it down thinner, serving both sides of each end similarly, but taking care that the edges are by no means bevelled. This operation must not be done quickly, or the rapid motion will take out the temper. The sides must then be made smooth, nearly polishing them, so that each time they are sharpened up they will have a keen and not a saw-like edge. Now hold the end of the knife upwards on the emery, and with an even sweeping motion round off each end to the arc desired, at the same time keeping the edge perfectly square; then smooth off as was done for the sides. When the edges are perfectly square, rest a short piece of board (the workman must sit on a low seat) from the chest to the knees, and having greased each end of the knife, place one end just over the edge of the board to the right, and hold it firmly there with the four fingers of the left hand. In the right hand take a smooth sewing or stitching awl, holding it between the handle and the point, and rub it across the knife backwards and forwards, keeping it quite flat on the knife; then turn the knife over, and do the other side and end in the saue manner. The edge of the knife should now point upwards, in a line from the knees to the chest. Press

the heelball cloth which is over the right hand against the corner of the knife nearer to the worker, and in the ends of the fingers hold the awl; put this right across the knife edge so that it forms a cross, thus making each corner space form a right angle. This should be continued through the remainder of the finishing, otherwise there will be rough burns. Now with a firm and steady grip close the right hand; this will evenly draw the awl over half the knife and down to the thumb. Each side should be treated in like manner till the four corners and centre have a fine line of very small burns over each edge. The knife should then be resharpened two or three times. To temper shoemakers' knives, heat them over a spirit lamp till they are just blue and etraw colour. Then put them quickly into water or oil, the latter for preference. preference.

Secret Compartment in a Drawer.—A secret compartment may be formed in a drawer by means of a false bottom, as shown in Fig. 1, which is a section through the front of the drawer, Fig. 2 being a cross section through one side. The real bottom is \(\frac{1}{2}\)in thick grooved into the sides and rebated into the front, as shown, a separate piece, as \(\frac{1}{2}\) being dovetailed into the sides to carry the back edge of the bottom. The bottom should be of thoroughly dry hardwood, planed true, and sunk slightly as shown, so as not to rub on the case. The height of the false bottom may be



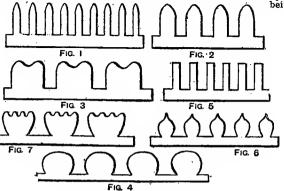
Secret Compartment in a Drawer.

regulated to requirements; in the drawing a space of \$\frac{1}{2}\$ in, is shown. This bottom would advantageously he made of three-ply veneer, but may be solid if very dry. It is grooved into the front \$\frac{1}{2}\$ in, and is fitted closely, but not tightly, to the sides. It rests on two slips or fillets B (Fig. 2) glued to the sides, and is in two pieces, the joint being about one-third of the width from the back. The whole of the bottom is covered with fine green cloth or leather, and this covering forms a hinge on which the front portion of the bottom works. The quarter-round head used to disguise the edges of the bottom is glued to the latter, not to the sides of the drawer, with the exception of the back piece C, which is fixed to the back of the drawer and forms a recess for the bottom to slide in. The side pieces of bead must be cut as shown in Fig. 3, which is an enlarged detail of the joint, the angle of the cut being \$5^*\$, and the starting point of the cut is distant from the joint the thickness of the bead. The action of the bottom is as follows: Press the finger and thumb down into the thumb-notch (Fig. 4) through the cloth, and push the bottom towards the back; when the front edge leaves the groove in the front, lift up the front portion, which reveals the hidden receptacle. If access to the whole is required, lower the flap slightly and draw towards the front, when the back edge will pass from under the bead C and the whole bottom may be removed. Replace by reversing the process. A portion of the back bottom must be cut away under each bead, as shown in Fig. 3, to permit the end to work.

Drying Beef Scraps.—Beef scraps used in rearing poultry are taken while fresh, mixed well so as to produce a good mixture of fat and lean, and compressed into small blocks, which are then dried as rapidly as possible in a current of hot air. The drying is probably done by placing the blocks on sheet-iron or wire-gauze trays, one above another, in a chamber through which the hot air is passed, the hot air being produced by blowing air through a jacketed chamber heated by steam under pressure.

Fixing Watch Hairspring to Collet.—A watch hairspring is fixed to its collet in the following manner. First lay the spring on a convex watch glass, and break out the inner coils until the opening in the spring centre passes easily over the collet with room to spare. Lay the spring on the glass, and bend the extreme inside end inwards to pin in the collet. Place the collet, right side up, on a broach held in the left hand. Pass the hairspring over the broach, and insert the end in the hole in the collet. File up a tapered brass pin, burnish it, and file a flat on one side to make the pin D-shaped. Insert the pin, held in the pin-vice, with the flat against the epring. Push the pin in tight, and see how much projects through the hole, then withdraw it, and cut off the surplus. The part of the pin that has to be cut off should first be cut half through with a knife; then again insert the pin, and break it off where half cut through; force it in tightly with tweezers. Place the spring on the glass, bend the eye true, then put the collet and spring on an arbor in the turns, and revolve slowly, and with tweezers set it flat and true. tweezers set it flat and true

Muslin Artificial Flowers.—The muslin or lawn for making artificial flowers may be purchased at any linen-draper's. Previous to using, the material should be starched and smoothed out with a hot iron to stiffen it. For cutting out the different patterns use a pair of sharp



Muslin Artificial Flowers.

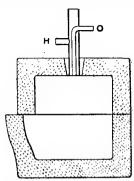
scissors. First cut the material into strips about 18 Inlong, the width varying according to the flower to be made. Now fold the strips in half again and again until the width will admit of one design being cut. Some flowers, such as the rose, will only require the end rounding off, but where the petals are long it will be necessary to cut downwards as in the dahlia and chrysanthemum. After cutting, unfold the pieces. In making flowers, take one end of the cut pieces in the left hand, and commence to roll very close a few turns to form the centre, then roll more loosely; gather up the muslin with the right hand until the whole is gathered in. Now take a piece of thin wire about 6 in. long, twist it round the flower two or three times, then twist the two ends together; now pull out and arrange the petals. The wire can be bought at any ironmonger's or fancy shop in rolls of 100 ft. for a penny. To make a dahlia, take the end of each petal of the strip between the thumb and forefinger, holding the bottom part with the left hand. Pinch the tip and twist it right over. To make the centre of the flower, take a piece of cotton-wool about the size of a walnut, roll it so that it can be taken hold of with the left hand, and dip it into the yellow dye before rolling the petals round it. Judson's or aniline dyes will be suitable for colouring the flowers. Figs. 1 and 2 show patterns for the dahlia and chrysanthemum, Figs. 3 and 4 for the rose, Figs. 5 and 6 for the daffodil, and Fig. 7 for the pansy.

Setting of Portland Cement and Lime.—Generally speaking, Portland cement swells in the act of setting, but so many things have to be taken into account that the above statement cannot be called a general rule. Much depends on the composition of the cement, on the nature of the aggregate, the cleanness of the sand, the amount of water, the method of mixing and laying in position, and on the weather during the time the concrete is setting. A practical test may be made by filling a glass bottle (such as a pickle bottle) to the brim with the concrete, the cement mortar, the grout, or the neat cement that is to be tested, the naterials being mixed in exactly the same way and under conditions similar to those existing on the works.

If swelling takes place in the act of setting, the bottle will be broken, or the material will rise above the brim of the bottle; if shrinking takes place, the material will sink below the rim of the bottle and away from the glass. Lime generally shrinks during setting, whether used in mortar or in concrete, and may be tested in the same way, though a considerable time will clapse before setting takes place in a bottle. Cement pointing will stand better than lime pointing, though much depends on the workman, the cleanness of the sand, and the dryness of the weather during the execution of the work.

Removing Copying Ink Marks from Bird's Wings. Removing Copying Ink Marks from Bird's Wings.—Copying ink may sometimes be removed with liquid ammonia applied in this case with a sponge or pads of cotton wool. Should this plan be unsuccessful, a strong solution of oxalic acid in water or of salts of lemon may be used; but it is almost impossible to eliminate such stains entirely. Use plenty of warm water afterwards and dry the feathers by an application of benzoline in a brisk draught.

Furnace for Melting Platinum.—The temperature required for melting platinum, being very high, cannot be obtained with jets of ordinary coal gas; therefore an oxyhydrogen blowpipe is used. This is constructed on the same lines as the blowpipe used in the oxyhydrogen or limelight, but on a larger scale, hydrogen being delivered to the wider tube H, and oxygen to



Furnace for Melting Platinum.

the inner or smaller tube 0. The furnace, as will be seen by the sketch, is in two parts, each of which is cut out of a solid block of quicklime. The upper and lower pieces are both hollowed out; the upper piece has a hole drilled through the top to take the blowpipe, while the lower piece is provided with a lip for pouring the metal after it is melted. The combustion of the gases would give more heat if the inner tube 0 were cut off a very short distance within the wider one, so as to obtain a better mixture. hetter mixture.

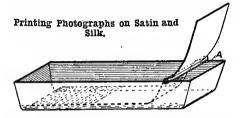
Blocking and Shading Letters.—If the colours for blocking and shading letters are mixed with equal proportions of oil and turpentine, and with enough driers to ensure drying within a few hours, there will not be much difficulty. The operator should possess a knowledge of light and shade, as well as of reflected light. In blending two colours, begin with the lighter shade at its greatest distance from the deeper colour, and as the penoil exhausts itself of colour only a small quantity will be left where the shades meet and blend. The colours should not be laid on heavily where they mingle; such a proceeding leaves the work streaky and makes the paint inclined to run. Flat brushes should be employed, and when the letters are large the use of a bender or softener is an advantage. If the ground on which the letters are to be blocked is dark, the blocking must first be painted in with white, ground up in turpentine and a little linseed oil.

Testing Lime.—Two qualitative tests for lime are the time required for slaking, and the amount of insoluble residue left after treatment with dilute hydrochloric acid. Place a piece of lime on a plate and sprinkle a little water on the lime; if the lime is of good quality and freshly burnt it will slake in a few seconds to a fine white, dry powder throughout. If the lime is old it will require a longer time to slake and will be covered with more or less of a hard crust that will not slake. If some of the slaked lime be placed in a test tube and covered with the dilute hydrochloric acid the lime will dissolve, with the exception of a very little siliceous matter that is usually present; a large residue would indicate an impure lime. Testing Lime.—Two qualitative tests for lime are the

Rich Matt Gilding on Clock Cases, etc.—The rich dead matt gilding on French art metal work, etc., is produced by a special application of electro-gilding. The figures and articles to be gilded are first prepared by several dipping processes in acid pickles and cyanide dips, the object being to obtain a perfectly clean surface free from blotches, stains, and marks of every description. The prepared surface is next electro-coppered in an alkaline coppering solution, then dipped in a weak solution of mercury, again lightly coppered, rinsed in clean water, then electro-silvered until it assumes the dead-white appearance of electro-deposited silver; the article is then rinsed in warm water and transferred at once to an electro-gilding solution; thus receiving a sufficiently good coat of gold. After this the article is again rinsed in warm water and dried. Success in this process is ensured by having all dips and pickles fresh and elean, all solutions in good working order, perfect cleanliness in the vessels and celerity in all the changes from start to finish. If all the baths are in perfect order, the various immersions will each 'occupy only a few minutes. The articles must be well rinsed after each dip and immersion, and must be quickly dried after the last good riusing. The regulation of current, temperature of gilding bath, anode surface, and time of immersion must be left to the skill of the workman.

Printing Photographs on Satin and Silk.—Photographs on each of the second of the work and the other war he of the second of the part of the workman.

Printing Photographs on Satin and Silk.—Photographs on satin, silk and similar fabrics may be obtained by several processes. The process described below will, however, prove quite simple. Mix 380 gr. of arrow-root to a thin paste with cold water, and add about 16 oz. of almost boiling water, and keep at this temperature until the solution is clear. Crush together pure crystallised ammonium chloride 150 gr., sodium carbonate 240 gr., citric acid 60 gr., and dissolve in 4 oz. of cold water. When the arrowroot is cool mix the two solutions,



pour the mixturs into a dish, and immerse the fabric for ten minutes; then remove slowly, draining well, and pin out lightly on a board to dry. A good plan is to draw the fabric lightly over a glass rod A, as shown in the illustration. The board should then stand in a warm room and dry quickly. Now make up a sensitising bath of silver nitrate 2 oz., citric acid ½ oz., and distilled water 16 oz. When the fabric is dry it should be immersed in this bath for three minutes, drained as before described, and when dry is ready for printing, which is carried out in the usual manner. The prints fix to a very pleasing warm sepia colour without touing, but may be toned in sulphocyanide 30 gr., gold chloride 5 gr., water 20 oz., like an ordinary gelatino-chloride print. Rather hard negatives are required for the process, such as are not very much under-exposed but have clear shadows and good bright gradations in the lower tones; otherwise the results will look flat and insipid. Print rather deeply. If preferred the fabric may be toned with platinum, but this method is expensive owing to the quantity of platinum used. The following process has also been recently suggested. Soak the fabric in potassium bromide 40 gr., cadmium bromids 15 gr., potassium bromide 40 gr., cadmium bromids 15 gr., potassium iodide 15 gr., water 8 oz.; when dry sensitise in silver nitrate 15 gr., citric acid 16 gr., water 7 oz. The print is developed or intensified with pyro 75 gr., citric acid 6 dr., water 7 oz., and is then fixed, or may be toned in the manner described above.

White Paste for Cleaning Brown Boots.—A white each for cleaning brown boots can be made easily by

White Pasts for Cleaning Brown Boots.—A white pasts for cleaning brown boots can be made easily by softening down in good turpentine one white glazingball (procurable of most shoemakers for a halfpenny) and 1b. of best white wax. Just enough turpentine should be used to cover the glazing-ball and wax when broken up into small pieces. Place the whole in a jar, on the hob, but not too near the fire.

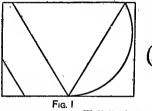
Composition of Resin.—Resin or colophony is a valuable product obtained by the oxidation of turpentine, and is contained in all crude turpentines. The turpentine as it flows from the various species of pine is a viscous yellow fluid very much like honey: if left in contact with air it oxidises and becomes a solid resin, the is, however, taken in the fluid state and distilled, when oil of turpentine or spirits of turpentine passes

over and resin is left in the retorts. It is not purified in any way, but is run direct into barrels in which it solidifies, and is shipped in that condition. It varies in colour from a very pale yellow to a deep brown. Resin consists principally of acids, chief among which is abietic acid.

Cycle-chain Rollers Sticking.—If the rollers in a cycle chain failed to revolve when the chain was new, the cause would be that the chain links were too tightly riveted at those parts in making up. The remedy will be to loosen the side plates by hammering one side of the rivet whilst the other side is supported on a hollow punch, thus releasing the pressure of the side plates on the roller. If however, the chain was satisfactory when new, and has since developed the defect, the cause is corrosion of the rivet and inside of the roller. The remedy will be to soak the chain for a day or so in paraffin or petrol, afterwards using force to move the stuck rollers. Then wipe and oil the chain, or, better still, place it in a shallow tin dish with some Russian tallow and let it simmer in the oven or on the hob. Finally, hang the chain up to drain, and wipe it, after which it is ready for use and will last for six months without re-doing.

Wall Pocket.—Wall nockets as illustrated for holding

Wall Pocket.—Wall pockets as illustrated for holding nails, pencils, etc., can be made according to the following instructions. Take a piece of cardboard or metal about 7 in. by 5 in., mark off ½ in. from each top corner, find the centre of the lower edge, and rule the V-shape, as shown in Fig. 1. Now bend back the sides along the V lines, bring forward the top corners to form the pocket, and fasten together the back edges with glue or solder. Then bore a hole at each side, and the pocket is ready to use. Of course, the sides can be rounded off or otherwise cut before bending, as shown in Fig. 1, or





Wall Pocket.

after bending, as illustrated in Fig. 2. To strengthen the pocket, and to do away with the necessity of joining the edges, the side flaps could be fixed on a back piece of any shaps, the top projecting slightly, so that one hole could be made for suspending instead of the two side holes. Fixed on the wall near a bench, these pockets are most useful for keeping together tacks, screws, hinges, nails, pencils, and other small articles, which are often otherwise so mixed up that considerable time is wasted frequently in finding something wanted there and then.

and then.

Coach-green Paints.—Coach-green paints are made by well mixing together in water variable proportions of gas light blue (commonly known as cheap Prussian blue), sinc chrome, raw Turkey umber, aud ivory black. In the lighter shades the black should be omitted. The colours used should be procured in their pure state and mixed to the desired shades, and if necessary reduced with best floated barytes. They should then be thoroughly ground through levigating stones, filtered, and dried. The exact quantity of each ingredient cannot be given, as the strength and depth of the colours vary.

Paste Wood-filler.—Paste wood-filler is much used on the Continent and in America for filling rough and opengrained wood. It may be made by grinding together 51b. of china clay and 41b. of corn starch or flour in \$pt. each of raw linseed oil and japan gold-size, and \$pt. each of turpentine and boiled oil. It may be tinted to resemble the various woods by adding: for light and antique cak, vandyke brown and raw sienna in various proportions; for mahogany, burnt sienna and venetian red; for ebony, lampblack; and for maple, white-lead and yellow ochre. It should be thinned down to the required consistency with two parts of boiled oil' and one part of japan gold-size, and it may be applied with a palette knife in a stiff paste for rough wood, but for tilling open-grained timber it should be thinned down somewhat, spread on the work, and allowed to stand about fifteen minutes, when the surplus filler should be carefully wiped off with a cloth. It should then be allowed from thirty to forty hours to harden before sandpapering, when the work may proceed in the usual manner.

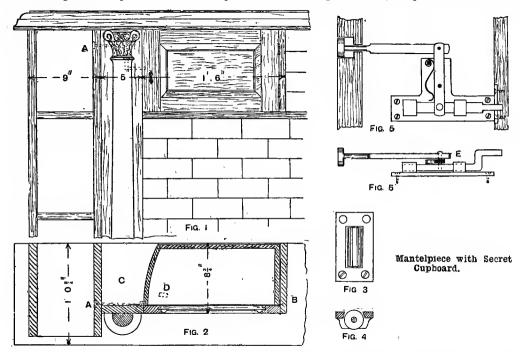
Purifying Benzoline.—Benzoline that has been used for cleaning purposes is purified by distillation. The apparatus required consists of a still of tinplate or sheet copper, and a worm of lead pipe placed in a bucket which is kept supplied with cold water by a tap, the excess of water being run off from the top of the bucket by the pipe. The still is heated by a gas flame, but as there is some danger of the benzoline taking fire it would be better to conduct the distillation with superheated steam through a jacket on the still.

Mantelpiece with Secret Cupboard.—One end of a mantel fitting with cupboard is shown in elevation and section by Figs. 1 and 2. The cupboard is covered by a door, hung on the right to the division between the shelves. On opening the door, nothing unusual is seen; the door shuts apparently against a rebate, and the opening is fitted with a shelf. However, on manipulating a button A, and at the same time drawing the left side of the cupboard outwards, it will revolve on the pivot or hinge B, and disclose the recess C. The cupboard must fit the opening accurately, its left-hand end, as shown in Fig. 2, being made to the sweep of the path of the cupboard when moving. The exact curve must be found by striking a circle from the pivot B as centre, and with the width of the opening as a radius. The cupboard may either be hung on small pivots sunk in the top and

sufficiently. Also if the mechanism shown is too near the cupboard, a similar lever and boit to a smaller scale could be fixed on the under side of the mantel-board, and could be actuated by a button or pull at the farther end of the mantel-board, the connection being by wire in a groove in the board.

Mending Violin Bow.—To repair a violin bow that is broken at the end, use hot glue. When the joint is dry, drill a fine hole through the back of the stick into the head, tap a piece of brass wire with a watchmaker's screwplate, screw in, cut it off close, and clean up.

Royal Green Pigments.—Royal greens are extensively need by coach painters and railway companies on account of their brilliancy, durability, and covering properties. They are not, like Brunswick green, easily affected by atmospheric influences, but retain their colour for a great length of time, especially when coated with a good copal varnish. In preparing these greens, palest and clearest zinc chromes, and Brunswick or Prussian blues are mixed in variable proportions according to the desired depth of colour. Celestial blue may also be used. The following is a formula for pale zinc chrome. Dissolve 101b. of bichromate of potash in 7 gal. of boiling water, and in a wooden vessel mix 61b. of zinc oxide with 2 gal. of water, and pour it into the bichro-

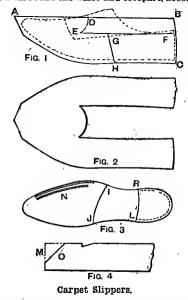


bottom of the frame, or hinged with butts sunk flush in the side of the cupboard. In the bottom of the opening a roller (Figs. 3 and 4) should be fixed, as indicated at D (Fig. 2), the axis of the roller being set on a line radial from the hinge, and if the cupboard is of soft wood, a thin piece of brass cut to a quadrant shape should be let in flush with the bottom, and on it the roller will work. The door is framed up of 1-in. stuff, and hung in the usual way. The cupboard is kept closed by a spring bolt, which is shown to a larger scale in Figs. 5 and 6. An ordinary cupboard neck bolt may be utilised, the knob being filed off, and the spindle turned into a pivot for the lever E. This lever and the horizontal bar attached to the push-button A (Figs. 1 and 2) may be made from for interest of the push-button and the end threaded for the disc. All the joints should work easily on the pivots, and a small spring should be fixed, as shown in Fig. 5, to keep the bolt normally shot, and it should be so arranged that the upper end of the lever presses against the back of the spring when the press button is flush with the side of the division. The striking plate of the bolt, which is let into the side of the cupboard, should be filed down to a slope on the inside, so that the bolt may slide easily into place when the cupboard is shut. The cupboard could not be hinged on the left hand, the door not opening

mate solution and well stir, and then allow it to repose about twelve hours, when it is boiled by means of a steam jet for one and a quarter hours, after which it is allowed to repose or precipitate, when it is filtered, pressed, and dried at a very low temperature. If desired, chromic acid may be used instead of bitchromate of potash. Royal greens may be prepared from the colours in their dry state by grinding or mixing them under an edge-runner mill, or by mixing and grinding them when in their pulp state, afterwards drying them in a stove. The latter gives the best and most uniform results.

Modified Crystoleum Photographs.—Squeegee on glass (an old negative glass, well cleaned, can be used) a bromide print that has beeu well alumed, and when the print is dry pour hot water on the back of the print until the paper begins to blister, when with care the paper may be stripped away, leaving only the film on the glass. Now paint on the film (with oil colour) the more delicate tints, viewing and repeating the effect of the colour from the glass side. A second glass is now mounted over the first, and the rough tints or broad colours painted on the second glass. The whole is then backed with a sheet of white cardboard, and bound around the edges with black paper like a lantern slide.

Carpet Slippers.—In making carpet slippers, first cut the pattern; fold a piece of paper, the fold AB (Fig. 1) running from the centre of the toe to about lin. above the back of the heel of the last. Pencil-mark it \(\frac{1}{2}\) in. from BC, and round the toe and bottom from A to C. Then just about where the last rises above the fold, mark the point E, and under B mark F, so that AB and EF are parallel. Then mark the curve at D about lin. from the point just above E, and cut the pattern to these marks. Fig. 2 shows the pattern opened out. The material and linings are cut to this, leaving in on the back for seaming. Sometimes the lining and the outsides are joined at the sides, as at GH (Fig. 1), the dotted lines in this diagram showing the last. The backs are seamed up on both the outsides and the linings, and they can be bound either before or after making. To make, while the sole is wet tack it on the last as when dealing with an inner sole, and when it is somewhat dry put three rivets up the centre, take out the side tacks, and trim it up to the last, as in Fig. 3, leaving about in. on all round the heel to form the seat. Take it off the last, and cut the fellow piece to it by tacking the two together on a board, being careful to put both grains, or the two flesh sides, together, otherwise they will be cut both for one foot. Then mark off the waist and heel at IJ and BL, and with compasses draw a line all round on the flesh side in. wide, not more, and a second one in further in, and then a third in, farther in. Now all round the waist and forepart, according to

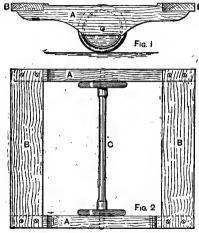


the substance required for the sole, take off an angular piece of leather, as shown dotted at M (Fig. 4). At the heel this need not be removed, as it forms a heel when only a sew round is wanted and a foundation when the heel is needed higher. With the point of the knife cut direct into the leather, about \(\frac{1}{2} \), in all round on the second line, and then open it with a channel opener. Next cut away the inner side from the third mark, as shown at N (Fig. 3). In this groove commence with the awl. For the heel bring it out on top, just in the first line, and for the forepart and waist bring it out just in the centre O (Fig. 4), and when both pieces are tacked again on the last, taking care to have the flesh side up, they are ready for lasting. The top is lasted and sewn the wrong side out, and as for an ordinary welt a long narrow strip of thin upper leather is sewn in. This, when the slipper is turned, forms a feather all round the forepart and waists, but at the heel it is not necessary, as the sole, helng the full substance, can be beaten down to the upper. When sewn, cutoff near the stitches all the surplus lining, stiffeners, and side lining, but do not cut away the carpet, or any cloth material that is used, otherwise it will fray in wear. It must be stuck down with wax or with German pasts. To turn, take both off the last and bend the sole right up the centre; then hend it the reverse way across the waist and push this through the upper, and by still hending the sole keep pushing it till all is through except the toe and heel. The work of turning the toe can be made easier by a long stick or a small hammer, the end of the handle being pressed against the toe and the part

that is inside, and the shoe being pulled till the whole is turned. Then heat the sole well on the lap-iron and put in a reverse last, and evenly hammer down the sole all over till it is quite smooth. The other slipper is served in the same way, and before it is quite dry the sdges and bottom are finished to fancy, the edge with a pump iron, and the sole by huffing, sandpapering, etc. When the slipper is quite dry, take out the last and put in a suitable sock, first pasting on the inside a skived piece of thin belly to form a stiffening for the waist, and fill up the extra hollow in the heel which the stiffener is sure to make. If a heel is wanted, this can be riveted on top before the edges are finished.

Hot Axle Arms.—If the axle is set and the axle arms fit in the boxes properly, they should not get hot in the running whilst there is oil in the cup and box. Perhaps the axle is not strong snough and so allows the wheels to spread at the hottom when loaded; or possibly the axle arms have not been finished off properly when made, or the axle has not been properly set. To remedy the second fault, with very fine emery powder grind the boxes on the arms afresh and so obtain a hetter finish.

Piano Trolley.—Fig. 1 of the illnstrations below shows a side elevation and Fig. 2 a plan of a simple form of trolley used for moving pianos. The two side pieces A are 2ft. 4 in. long, 4 in. deep, and 1 in. thick, the end pieces B being I ft. 8 in. long, 4 in. wide, and 1 in. thick; the end pieces are let into the side pieces for half their thickness, that is ½ in. The wheel spindle C is shown to pass through holes bored in the side pieces, wheelharrow fashion; for occasional use this plan



Trolley for Moving Pianos.

answers very well. For daily usage, or if the trolley is also intended to carry heavy grand pianos, the better plan is to use hearings as for grindstones, one half to be let in on the under side of the side piece, or the sides must be reduced to 3in. deep, otherwise with 6-in. wheels the instruments would require lifting np very high to enable the trolley to be put under. Another form of trolley has four wheels, to use which the instrument has to be lifted bodily and placed on the trolley, whereas with a two-wheel trolley one end of the instrument only requires to be lifted up whilst an assistant puts the trolley under it, the wheels being in a line with the centre of the foot pedals; the load is thus evenly balanced. The tops of the wheels must be lower than the top side of the end pieces to allow clearance. It is also a good plan to pad these pieces with several thicknesses of carpet to prevent the instruments slipping.

Simple Oil Press.—A simple oil press may be made in hardwood about 1½ in. thick. Cut two pieces 2 ft. by ift., and holt them together by four bolts about 1 ft. long. Another loose board of the same thickness will slip between the bolts with two wedges. The crushed seed must be heated, preferably in a steam-heated pan, then placed in a strong cotton bag, which must be tisd at the neck, and the bag being then placed between the two boards, the loose board is brought against it, and the wedges are gradually driven in. This will compress the bag, and the oil which exades may be caught in a vessel below. This is a wasteful process; the oil should really be taken out with a hydraulic press.

Lever Watch Stopping in One Position.—To find the cause of a 1-plate lever watch stopping when placed on its back, see whether the pivots come properly through the jewel holes and touch the endstones. See also that the hairspring is quite free and that there are no pieces of hair or fluff on the balance. If the pivots or jewel holes are wrong, the fault can be at once detected by removing the roller and hairspring and running the balance alone, noting whether it spins freely in any position.

Two-panelled Door.—Fig. I shows an ordinary two-panelled door 2 ft. 9 in. high, 1 ft. 1 in. wide, and \(\frac{1}{2}\) in. thick. The stiles and top rails are to be \(2\)\frac{1}{2}\in. wide, the middle rail should be \(2\)\frac{1}{2}\in. wide, and the bottom rail \(3\)\in. wide. Fig. \(2\)\ is a vertical section, and Fig. \(3\)\ conventional details of the three different kinds of joints,

that the pattern is also well greased, and then place it in the centre of the frame, running in more cream till the pattern is exactly half covered. Allow this to dry well, and, after trimming out a couple of check ways so that the mould halves fit well together, rub the dry curface with grease, preferably vaseline, and cover the pattern with a further quantity of cream till a thickness of li in. is made over the top of the pattern. Allow this to get thoroughly dry, when the plaster mould will leave the wooden frame, and should also part easily at the middle. The pattern can be removed, and the gates next put in with a rough file. The mould must be absolutely dry before use, or it will undoubtedly crack. The two halves can be put together and held in place by a small wooden cramp, when the molten tin may be poured. If a large number of castings are to be made, it would be well to have an iron mould prepared by any local ironfounder. local ironfounder Filling for Modelled Copper.—Ordinary good plaster-of-Paris will make a suitable filling for thin modelled copper, especially if mixed with water tinctured with thin glue. This can be mixed and run into the ornament, and will fill up all hollows and interstices. Care must be exercised to run the mixture level over the pattern. Keene's cement mixed in the ordinary way will also be a suitable filling. Tool for Bending Metal Beading.—Figs. 1 and 2 illustrate a useful tool for bending the silver and brasa beading that is used in carriage building. It will 늯 6.5 FIG. I FIG. 2 Fig. 3 FIG. 2

Two-panelled Door.

where it will be seen that the tenons of the top and bottom rails have haunches. It will also be noticed at Fig. 3 that the mortises are made broader on the outside of the stiles so as to allow for wedging if desired. The plough groove thickness of the tenon and mortises would be in. The panels could be in. finished in thickness, or if desired a little thicker they could be bevelled at the back. After the joints are made and the whole is fitted together, the joints should be glued, cramped up, and wedged in the usual manner, and the outside finished off with moulding round the panels as shown at Fig. 1. shown at Fig. 1.

Moulds for Small Tin Castings.—When a few small castings are wanted in tin, a good plan is to make a mould from Parian cement, using the article as pattern and casting the others in this mould. First make a small wooden frame sufficiently large to allow a margin of 1½ in. at each side of the pattern and on the top and bottom. This frame must be well greased on the inside to allow the mould to leave freely. Place the frame on a piece of glass, and after making a cream of Parian cement and water (well beaten up to remove air bubbles), pour the cream in the mould frame on glass to a depth of 1½ in. and allow it to get cold. See

bend nearly any sweep without bruising the bead. To make it, shape a piece of tough straight-grained ash 12 in. by $2^{\frac{1}{2}}$ in. by $\frac{3}{4}$ in. as in Fig. 1. The radius of the arms must be made to suit the work in hand, and the slot must be made to the shape of the bead. To use the tool, take the bead in the left hand and the bender in the right hand, slide the bead through the slot, and press according to the curve required.

Tool for Bending Metal Beading,

Photographing on the Human Skin.—To print photographs on the skin, rub on a solution of silver nitrate, using a tuft of cotton-wool, and fasten over the sensitised part a flexible film; then expose to the light for some time, taking care not to shift the film. The image formed on the skin should be fixed by washing over with hyposulphite of soda. The image will be of a brown black colour, and perhaps a nearer approximation to tattooing would be obtained by the use of an iron salt, for in that case the image would be of a greenish blue. Soak the skin (washing it first with hot soap and water) in a 25 per cent. solution of citrate of iron and ammonia. Print as before for about twenty minutes in bright sunlight then rub over gently with a 25 per cent. solution of cotassium ferricyanide, and well wash in warm water centaining a little citric acid.

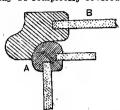
Working Fountain for Bay Window.—For constructing a working founts in for use in a bay window, first make a sheet-zine tray about 2 ft. in diameter and 2 in. deep. At one side screw in a piece of \(\frac{1}{2} \) in. brass tubing, making the joint water-tight with red-lead. Allow the tube to project into the tray \(\frac{1}{2} \) in. Have two \(\frac{1}{2} \) gal, cans, each with a cock in the side close to the bottom; an ordinary \(\frac{1}{2} \) in. brass cock will be suitable. Fit up a wooden stand to hold the tray about 3 ft. from the ground, and, by means of a piece of \(\frac{1}{2} \) in, rubber tube, connect the tube on the tray to the mouth of one of the gallon cans. Screw into the centre of the tray a small tube with a fine nozzle, making the joint water-tight with red-lead. Now fix a pulley in the roof of the bay window rather on one side. Procure a square board large enough to stand one of the gallon cans on, bore a hole at each corner, pass a cord through each hole and knot the cords, then tie all the cords together and pass a single cord through them, thus forming a sling on which one of the cans may be raised through the pulley to the roof of the bay. Connect a small rubber tube from the tap in the can to the small tube in the zinc tray, turn on the tap, and the iountain will work. When the water has all run out, put the full can in place of the empty one and raise it to the roof again. The water can be regulated either by the cock or by the height to which

Remedying Scratched Glass of Counter Case.—To repolish the defaced plate in the top of a counter case, it would be necessary to take out the plate and send it to the works. To attempt to repolish the plate in its original position would prove tedious and unsatisfactory. The defaced part may be completely covered by a movable

show, and if it is too thick the white will look yellow, the bines green, etc. "Nelson's Hard" gelatine is a good brand, and alb. dissolved in 1gal of water will do as a starting solution, for water or gelatine may be added at any time. A sheet of plate glass is made perfectly clean, well polished, and rubbed with French chalk, and on this plate a thin film of gelatine is spread. A quantity of gelatine is poured on the centre of the plate, which is moved gently so as to allow the little pool to reach the four corners in succession. The surplus gelatine is allowed to drain off one of the corners. The print before being mounted on the card is laid down carefully on this gelatine, the air being expelled. Gently press towards the edges of the print with a rubber roller or squeegee, when the print must be set aside to dry in a warm room. When dry it will peel off, or in fact fall off the glass, and the surface will be very highly glazed. Sheets of ferrotype or celluloid may be used instead of the glass plate. The gelatine soon becomes yellow, and much more serviceable showcards could be obtained with paper varnish, which can be washed. Celluloid varnishes have now displaced gelatine.

Repairing Chiffennier Door.—Repairing a chiffour

Repairing Chiffonnier Door.—Repairing a chiffounier door where the stud hinges have been broken off and there is a difficulty in removing the upper part is a rather awkward job, though it may be accomplished in the following manuer. Fit two pieces of well seasoned English elm at the upper and lower corners of the door; these should be slightly dovetailed as shown in end view



Section of Corner of Counter Case.

ould be with a lding is Door. Fig. 3

plate, if this is desirable. The required plate would be very slightly larger than the present one, with a moulding on the back and front edge. The moulding is prepared to fit over the rim A of the counter case (see sketch, which is half full size), and is grooved on the inner edge to receive the \$\frac{1}{2}\$-in. plate B to fit tightly into the groove; the moulding is prepared from a piece of hard mahogany, and polished clean or ebonised to match the counter case, and is then cemented to the glass with a solution of strong glue and lampblack. The exposed edges of the glass are polished.

at C (Fig. 1). Each piece is secured with two screws a (Figs. 1 and 2) from the inside. The new stude B are then let in and screwed to these pieces, but they must occupy the original position. The screws are next taken out and the dovetailed pieces withdrawn and slipped in their positions C (Fig. 3) in the chiffonnier frame, hot glue being applied to the joining parts, and the door is slid over the dovetails. The screws will then house in well, and this completes the job.

Bronzing Iron.—To make a good finish, first have the irou heavily copper plated by means of the electrical process. When this has been done, the copper on the iron can be bronzed by the following method. Mix up some crocus of medium colour and make a cream of this rather thick. With a camel-hair brush paint on the crocus cream evenly and allow it to dry. Then hold it over a gas flame till the surface is black with carbon, and then over a clear firs till the carbon has been thoroughly burnt off again; when cool, well brush with a hardrush. The surface will have a colour about the same as fairly deep yellow bronze. This must then be covered with a transparent lacquer, when the colour will keep for an indefinite time. This method is generally used in bronzing copper goods, but a good deposit of copper must first be made or the heat will tend to strip off the copper. If this plan is too complicated, the following might be tried. To a pint of methylated finish add 4 oz. of gum shellac and 4 oz. gum benzoin, placing in a warm place for a time and shaking occasionally till dissolved. Next leave in a cool place for three days to settle. Then pour off, and cork well. Next get a little bronze green finely ground, and vary the colour to that required by adding yellow ochre. Mix this with a little of the first named varnish, slightly warm the iron, and lay on a very thin even coat and repeat until the iron is well covered. When finally dry, varnish over all.

Gelatining Showcards.—The process of gelatining

Filter for Oils and Essences.—For filtering oils, essences, or perfumes, providing they are coarse, make a long conical bag of fine linen, stitch the open end on a ring of wire, and support this by four cords to a hook at a convenient height. When filtering, keep the bag well filled with the liquid. For filtering out fine material, cut a circle from a sheet of white blotting-paper, fold the circular piece twice, so that it forms a cone with a rounded base, open the paper out, place it in a ribbed funnel, and filter through this. The first filtration may be done through the linen, and the second through the paper, to obtain a clear oil or essence.

Gelatining Showcards.—The process of gelatining showcards resembles that by which glazed photographic prints are produced on gelatino-chloride paper or P.O.P. Make a solution of pure gelatine in the usual manner. This solution may be thick or thin as desired, but the thinner it is the clearer the colours of the card will

Proper Position for Posts.—Fences and posts are often put up wrongly simply because of ignorance of one important detail. Wood posts should always be inserted in the earth in a natural direction, for when they are placed in the position they would occupy if growing, they do not decay readily at the top. A sound reason for adopting this course has been found by extensive microscopic examinations, which have fully proved that the moisture in wood always passes in the direction of natural growth. For instance, if the top of a post is fixed in the ground, and the butt is allowed to assume a position exactly opposite to that it would occupy if growing, it would decay rapidly, for the reason that the moisture would act in the manner described. Workmen sometimes wonder how it is that one post becomes rotten twice as soon as another post which was planted at the same time and cut from the same timber, and never dream of accounting for the fact on the principle of natural growth

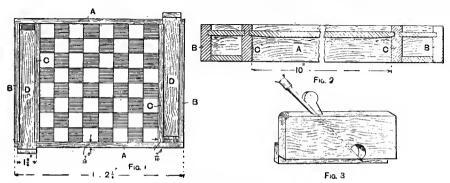
Removing Paint from Brass Frames.—To remove paint from brass frames, warm a small quantity of turpentine in an earthenware vessel, and in this repeatedly dip the frame; then sprinkle over it finely powdered pumice stone, and scrub with a hard brush, which should remove the paint from the crevices without affecting the surface of the brass. If this fails, the only method is to paint over the frames a strong caustic-soda solution, made by dissolving 1 lb. of caustic soda in 1 pt. of hot water. After the paint has softened, scrub down well with a brush, using flour pumice stone, and finally rinsing down with plenty of cold water to remove all alkali.

Draughtboard with Drawers.—The draughtboard illustrated by Fig. 1 has two small hoxes in which to keep the men. The outside frame is made of pine 1½ in. wide by ½ in. thick. There will be required two sides A 14½ in. long, and four pieces 10 in. long for the ends B and partitions C. The partitions are grooved on both sides, and the side- and end-pieces on one side only. The grooves are ploughed ½ in. wide and ½ in. deep ¼ in. down from the top, as shown in section at Fig. 2. The playing loard is next dressed up 10½ in. square and ½ in. thick, and is chamfered down on the bottom edge all round till it is a tight fit in the grooving. Mark out the squares on the board and colour them. When dry, nail the frame together round the board as shown in Fig. 2; then get out two strips of pine 10 in. long, 1½ in. wide by ½ in. thick, and nail them in position as a bottom for the side boxes. Two covers D (Fig. 1), 10½ in. by ½ in. by ½ in.

conrse, driven off as soon as steam heat is attained, but sut 300°F, the wood begins to be structurally affected, and iche wet carbons begin to break up. Gases are the first to come over, and as the heat increases wood-naphtha and spirits of turpentine are produced. At 350°F, light, red-coloured oils of a specific gravity of 0'88 to 0'90 are obtained. With more heat the heavier oils are sent over, until, when the temperature has reached 600°F, the density of the oil has risen to 0'98, and various chrysolic compounds are in evidence as well. The aqueous distillate at this stage shows a high percentage of acetic acid, which continues to increase as the specific gravity of the oil increases. The distilling operation eventually goes up to about 900°F, when little except pure charcoal (the mineral matter varying with the kind of wood) is left. Thus a retort charged with 4,575 lb. of ordinary pitchpine wood gave the result stated below (from a paper by Mr. F. Clark, Columbia College, N.Y.):—

| | Gal. |
|---|------|
| Light oil (of sp. grav. 0.875 to 0.95) | 13 |
| Heavy pine oil, or dead oil (sp. grav. 0.95 to to 1.04) | 731 |
| Pyroligneons acid (sp. grav. 1.02) | 185 |
| or a meau yield of :- | |

The pyroligneous acid is of a yellowish or reddish colour, and contains 4 per cent. of hydrated acetic acid. This acid in its crude state is used in the manufacture of



Draughtboard with Drawers.

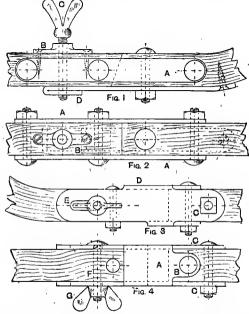
will also be required. Cut away the sides where the covers enter down to the bottom of the grooves, slide the covers in place, and it a strip i in thick across the end of each, to make good the gaps as shown at Fig. 1. These strips also stiffen the covers. Stain the covers and frame with Bismarck brown, and varnish them. A home-made plough suitable for this job is illustrated at Fig. 3, a i_i in chisel being made to do duty as the iron. It may be made of soft wood, and will last long enough to make half a dozen frames. If the frame is made i in or i in deeper it will be deep enough to hold chessmen.

Products of Conifers.—Particulars of all the products (resin, turpentine, tar, pitch, charcoal, potash, and gum) obtained from Weymouth pine, Northern pine, pitchpine, spruce, and larch would be too many to be given here, and the enumeration of the products of one of these trees must, therefore, serve as a type of all. The natural products are named in a few words. The wood is an important product in all cases. The Weymouth pine furnishes soft needle leaves that are used as litter bedding, and the cones of this tree make good fires. The same may be said of the Northern pine, except as regards the leaves. This tree would also yield a resin similar to Bordeaux pitch aud turpentine, but the Northeru pine appears to be grown for the sake of the wood only. The pitchpine yields the various grades of this tree are split up and used in the manufacture of coarse fabrics and as stuffing for furniture and general packing purposes. The larch yields the viscid Venice turpentine. The spruce yields the pitch known as Burgundy pitch, but only a small quantity of spirits of turpentine. In the destructive distillation of wood the products multiply in number, and for this reason pitchpine has been chosen as probably being of more general interest than some of the other trees named. When pitchpine wood is cut up into short blocks and placed in a closed iron retort, and the retort gradually heated, nothing of importance happens until a temperature of about 300° F. is reached. The moisture in the wood is, of

pyroligneate of iron (black dye), and also for the preparation of acetate of lime, acetate of lead, and pure acetic acid. The light oil is used for dark paints that are good for store and metal, but not suitable for wood. The heavy oil is sometimes redistilled, and is the creosote used in wood preservation.

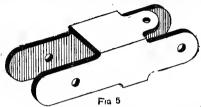
canvas Blackboards.—Below is described a method of making portable canvas blackboards. The canvas must necessarily he stout and as free as possible from knots. Where these occur, flatten them by holding a flat-iron underneath and striking the upper surface a few light blows with a hammer. The canvas should next be evenly stretched on a large board or framework by nailing tacks round the edges about 2 in. apart. The surface of the canvas should next receive two coats of white-lead oil colour to which lamphlack has been added, and to ensure quick and hard drying, patent driers should be used and a fair quantity of turps. These coats should be allowed to dry for a few days so as to become hard. The surface should then be rubbed down with pumicestone and fine glasspaper. Then a third coat should be applied. After this has become well set, it should be rubbed down with fine glasspaper. Should a fine surface be required a fourth coat may be necessary. Finally, the surface may be treated as follows. Get of ultramarine blue 40%, shellac 11h, ivory black 80%, finest flour emery 50%, shellac 11h, ivory black 80%, finest flour emery 50%, alcohol 1 gal. The alcohol and shellac must be well mixed together before the other ingredients are added, and then the whole is mixed; it must be kept tightly corked, and before being used must be well shaken. As the solution soon sets hard, just enough for immediate use should be poured out into a pot. The solution should be applied with a flat varnies forst coat, and when dry rubbed down with very fine glasspaper or pumicestone. The blackboards may be used on rollers, or the carvas may at once he nailed ou to a permauent stretcher, or if required the canvas may in the first coat, and when dry rubbed down with very fine glasspaper or pumicestone. The blackboards may be used on rollers, or the carvas may at once he nailed ou to a permauent stretcher, or if required the canvas may in the first instance be fastened to the original stretcher.

Fitting Folding Shafts to Baby Carriages.—In the accompanying illustrations two different methods of arranging the folding shafts of baby carriages, mail carts, etc., are shown. The easier to construct is illustrated in side elevation by Fig. 1 and in plan by Fig. 2, and for it three iron plates, a special nut, a thumbserew, four bolts and nuts, and a few wood screws are needed. Two of the plates A are each 6 in. long over all, the cross-section being \{in. by \{\frac{1}{3}\ in.\}; the ends are rounded (see Fig. 1) and three \{\frac{1}{3}\ in.\ holes are drilled, the two end holes being each on centres at \{\frac{1}{3}\ in.\ from the extremities, while the centre of the remaining hole is \{\frac{1}{3}\ in.\ from that of the right hand hols, and consequently. \{\frac{1}{3}\ in.\ from the centre of the left-hand hole. The cart shaft is out on the slant, the top of the face being say \{\frac{1}{3}\ in.\ from the contre of the left-hand hole. The cart shaft is out on the slant, the top of the face being say \{\frac{1}{3}\ in.\ from the contre of the left-hand hole. The cart shaft is out on the shaft one of the plates is firmly secured by \{\frac{1}{3}\ in.\ holts with cup-shaped heads (see Fig. 2) and square nuts, holes being drilled horizontally. The shaft should be a tight fit to the shanks of the bolts so as to brevent the bolts revolving when the nuts are turned



with a spanner. Midway between these bolt holes, but in a vertical direction, another 1-in. hole must be drilled centrally with the shaft, and above it is placed the brass nut B (Figs. 1 and 2). This is tapped 1-in, to take the thumbscrew C (Fig. 1), the screwed shank of which is about 2 in. long. The nut is held in place by two wood screws, and, as shown in plan by Fig. 2, is quite simple in form; more ornamental nuts can, however, be smplied by most makers of, or dealers in, baby carriages. The portion of the shaft that is to move must next be treated, its end being cut to fit the slope of the fixed portion. Then while it is offered in place, the hole, for the iron side-straps should be marked, a scriber moved round the hole in the plate being used to scratch a circle on each side of the folding shaft in the ordinary way. Of course, before this is done it should be seen that the centres of the two end holes in the plates are at the same level, and, as tending to ensure this, it is well when first dealing with the plates to clamp them together and drill them both through at once. A wrought-iron plate, in. by fin., should next be cut to about 7\(\frac{1}{2}\) in. long, and one end should be heated and bent round sharp as shown at D (Fig. 1), the length turned over being, say, 1\(\frac{1}{2}\) in. On the centre line, at \(\frac{1}{2}\) in. from the bend, the iron should next be drilled and tapped \(\frac{1}{2}\) in. the hole, of course, going through the two thicknesses of metal. Then on a centre about \(\frac{3}{2}\) in the instant a plain \(\frac{1}{2}\) in. the hole of the shaft is reached, for a stout wood screw, as shown in Fig. 1. This plate is then held by its tapped hole and the movable end being secured in position by the side straps, the holes for the bolt or bolts, as the case may be, are marked off on the wood with a scriber after

the necessary drilling. The whole can then be fixed and painted to suit the remainder of the carriage. The lengths of the holts will, of course, vary with the sections of the shafts; these are usually 1 in. or 1½ in. square, and if the bolt shanks are about 1½ in. long they will probably be suitable. The action of the appliance is, of course, quite clear. The illustrations show the two halves of the shaft fixed; but to fold one end over the body of the cart, the thumbscrew is withdrawn from the bottom plate, when the moving part will turn on the end bolt as a pivot. This end of the shaft may be slightly narrower than the fixed end. A more satisfactory device is illustrated in elevation and plan by Figs. 3 and 4 respectively. Here the abutting ends of the shafts are square, the drawback being that a casting is necessary if a neat result is desired. This casting takes the form of an open-end box, which fits easily over the shaft ends to be united, the metal being as thin as can be cast satisfactorily. The part of the casting marked A (Fig. 4) is therefore a hollow square io section and about \$\frac{1}{2}\$ in. wide, and to the right of it are two pairs of lugs one pair B connected to the horizontal faces being \$\frac{1}{2}\$ in. wide, and to the width agreeing with that of the shafts to be joined. These lugs are drilled for \$\frac{1}{2}\$-in. or \$\frac{1}{2}\$-in. holts, and by them the casting is secured to the fixed end of the shaft, which enters the hox part by about \$\frac{1}{2}\$ in. long, while the sides ar-joined to long lugs on the left hand, so that the over all length of the casting is about 5\frac{1}{2}\$ in. long, while the sides ar-joined to long lugs on the left hand, so that the over all length of the casting is about 5\frac{1}{2}\$ in. long, while hy say I in. long, and through the slots passes a \$\frac{1}{2}\$ in. bolt \$F\$ (Fig. 3), the opening being \$\frac{1}{2}\$ in. bolt \$F\$ (Fig. 4) with fly nut \$G\$. For this bolt, which is squared for a very short distance under the lead, the movable part of the shaf



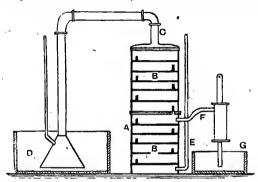
Fitting Folding Shafts to Baby Carriages.

2\(\)in. from the end, and the pull of the shaft is still further secured by a \(\gamma_1^2\)-in. bolt fixed vertically; this could, however, he omitted. To release the handle, the fly nut G should be slackened, when the movable end of the shaft can be pulled out of the socket A (Fig. 4), and will turn on the bolt F into the desired position. The casting forming the socket piece is illustrated separately by Fig. 5. A somewhat similar casting is used with shafts that are removable but do not fold back over the slot. The shaft is cut in two as in Figs. 3 and 4, and the movable piece is clamped in place by thumbscrews, which are removed when the curved end of the shaft is for any reason to be taken away.

Calculating Velocity of Flow in House Drains.—The available rules can do no more than give an approximate idea of the quantity of sewage discharged through house drains. Amongst the many formulas given by authorities on the subject, Mr. Hawkesley's formula may be accepted as furnishing the nearest to the actual results. This formula is $V = 77 \sqrt{\frac{H D}{H + 24D}}$, in which V = velocity in yards per second, H = head in inches, D = diameter of pipe in inches, and L = length of pipe in yards. As an example, take a 6-in. drain 90 yd. long and having a fall of 1 in 60. In this case $H = \frac{90}{90} \times 3 \times 12 = 54$ in. Then $V = 77 \sqrt{\frac{54 \times 6}{90 + (24 \times 6)}} = 1.3629$ yd. or 4.0887 ft. velocity of flow per second. And this gives $4.0887 \times 6^3 \times 0.34 \times 60 = 300$ gal. per minute. In the latter working 0.34 = gal contained in 1 ft. of 1-in. pipe. If the drain is flowing half full, only one-half the above quantity would pass through in the given time of one minute. Box's rule, already mentioned (see Series I., p. 69), is as follows. $G = \sqrt{\frac{(3d)^3 \times H}{L}}$, in which G = gallons per minute, H = head of water in feet, and H = length of pipe in yards. In this case H = $\frac{(3 \times 6)^5 \times 4.5}{90} = 310$ gal. per minute, or a little more than was found by Hawkesley's rule. If the drains are not properly laid, and the joints of the pipes have sharp edges that cause eddies inside the drain, the discharge would probably be less than that given by either of the rules mentioned ahove.

Making Walking Stick from Shark's Backbone.—
If the shark's backbone is at present in a dried and therefore hard condition, remove the spinal arches with a knife. Then, with a rasp, the edge of a piece of glass, and sandpaper, make it as uearly as possible round. Soak then in water until it becomes quite pliable, and, attaching a heavy weight to the lower end, hang it up to dry. For a bent handle, secure the upper end over a circular beam. Finish off when perfectly dry by further smoothing down with glasspaper, fixing a ferrule, and French polishing.

Manufacture of Sulphate of Ammouia.—The apparatus used in the manufacture of sulphate of ammonia cousists of a cylindrical iron still A (see the illustration) divided into a number of chambers by iron plates B: in each plate is a hole fitted with a short piece of tubing, and the holes are arranged alternately opposite each other. At the upper end of the still is an iron pipe c, curving over and connected to a large leaden bell, dipping into a lead-lined wooden trough D. A steam pipe E enters the still at the bottom, and about half way up another pipe F is fixed and connected by a pump to a small tank G of slaked lime. The method of working is as follows. The gas liquor from a tank above is allowed to flow in a gentle stream through a pipe into the upper compartment of the still; it flows on to the iron plate and when it has reached the height of the tubeit flows into the next compartment, and so on right through the still. The steam passes in the reverse direction from below upwards and heats the gas liquor; free ammonia, carbonate of ammonia, and sulphide of ammonia are driven off by the steam alone in the upper compartments of the still, while the fixed salts of



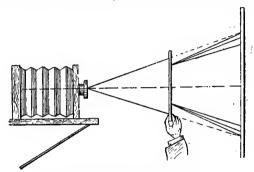
Apparatus for Manufacturing Sulphats of Ammonia.

ammonia are decomposed by the lime pumped in lower down. The whole of the ammonia salts are decomposed, and the ammonia passes through the pipe to the leaden bell, which is covered with sulphuric acid in the tank. Sulphide of ammonia passes over with the ammonia, and being decomposed by the acid liberates sulphuretted hydrogen, which is carried off from the bell by a small pipe and is sent into an oxide of iron purifier. The process is quite automatic, the flow of gas liquor and lime being regulated. The sulphate of ammonia crystallises out of the acid at once, and is fished out with a perforated shovel and drained on sloping floors covered with sheet lead.

Burning Joints for Sheet Lead and Pipe Lengths.—The burning of sheet lead, although easy to do, is but little practised. Supposing, for instance, that a piece of milled lead of a certain size is required, and the plumber has not at hand a piece that is large enough. Two or more pieces, which if joined together would meet the requirements, may be available; or, if a longer piece of pipe than any to hand is wanted, and it is desired, therefore, to join two shorter lengths without wiping a joint; in either case the desired object may be secured without the aid of any burning apparatus except the copper-bit, which for preference should be a hatchet-bit. In the case of sheet lead, the edges are straightened and butted together, the edges being cleaned and scraped down to a V-joint. These edges are dressed down perfectly flat on a flat bar of iron that has been warmed, while the copper-bit has been made very hot—sufficiently hot to burn through the lead easily. Previously, strips of lead ahout jin or jin. wide have been prepared, and scraped clean for filling the joint which the copper-bit burns away. Start at the end with the copper-bit, and burn through the two edges of the prepared joint while holding the strip of prepared lead to the copper-bit close down to the joint, so that the two edges and the lead strip are molten

together. Keep the strip of lead passing down quickly enough to have sufficient lead to fill the joint well. The whole then becomes one sheet, and any increase in thickness can easily be scraped down. No flux is required, but only a clean copper-bit and bright lead for the joint. The only difference between the sheet and the joint is that the former is milled and the latter is cast. In making a joint to a length of pipe, four burnt joints are necessary. The pipe is squared off, and a butted joint made having points marked on each side. The pipe is now slit a short distance at these points, and the ends of the pipe are opened and flattened out, thus making two flat joints across the pipe. For these joints proceed as before, and when they are perfect and the irregularities have been cleaned off, insert the mandril and dress the flattened sides to it, leaving a joint on each slde to be burnt. A piece of iron piping should be inserted to bur uon, care being taken that the lead at the joint fits the pipe. The two joints are now burnt and cleaned off, and the pipe is cleaned up, leaving hardly any trace of the joint. The iron in which the joint is burnt greatly assists the copper-bit. A large bit is preferable as retaining more heat. With a little practice good joints can be made both neatly and expeditiously, and a saving of material is in many instances effected.

Vignetting Bromide Enlargements.—Photographic vignetting glasses are only made to sell to amateurs, and should never be used for vignetting; these glasses are worse than useless. Cut the vignettes from cardboard as required: each picture needs a different shaped vignette. Old plate boxes answer very well as vignetters, for they keep the vignette away from the negative; without such aid even a passable vignette cannot possibly be



Vignetting Bromide Enlargements.

secured. For enlarging, the vignetting card is held between lens and screen (see the illustration) and kept moving. No advantage is gained by serrating the edges, Vignetting is a hideous practice except when applied to light effects against a light background; any deep shadows near the margin must be blocked out on the negative.

Facing Printing Type with Copper.—To deposit an adherent coat of copper on printing type, first remove every trace of dirt and grease by brushing with a hard fibre brush dipped in a hot solution of potash. Then after the type is wired (so as to provide an electrical connection between the battery and the face of the type where the deposit is to be made) swill in the potash liquor and transfer at once to an alkaline depositing solution of copper previously connected to a dynamo, when the required coat of copper should be deposited without loss of time. If the object is to give a hard face to the type, this coat of copper should be the thinnest film possible, to serve only as a medium between the type and the real hard face of nickel or of iron. The coppered forme must then be removed at once to the iron or nickel solution and a hard face of either of those metals deposited thereon. The deposit of iron must be well washed in very hot water, dried by dabbing with clean rag, and oiled to prevent rust. But all these processes will destroy to a certain extent the sharpness of the type, which will be much blurred if a thick coat is deposited on it. To get a hard copy of a forme tits usual first to take a mould of it in wax, coat this with blacklead to make it conductive, and deposit an electrotype copy of copper on it. The thick shell of copper thus obtained is an exact copy of the type with all its sharpness. The shell, when removed from the wax mould, is next backed with a support of type metal, and then mounted "type high" on a backing of hard wood to fit it for the printing machine. This may be "steel faced" if a very hard face is required.

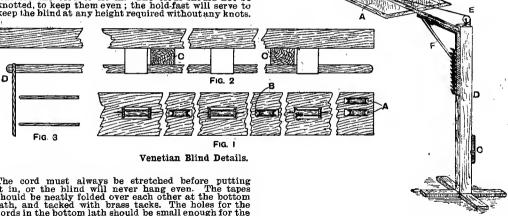
Polishing Rock Specimen.—The usual method of polishing rock, providing a flat surface is to be dealt with, requires some considerable amount of work. The best plan of polishing a rock specimen is to commence by well rubbing the surfaces with coarse and then with fine emery powder, and again with pumics powder. Then polish well with a paste composed of putty powder (oxide of tin) or whiting saturated with methylated epirit, applied by means of a chamois leather or buffer. This means of preparation will ensure a lasting gloss; but should the method be considered too trouble-some, try the application of a coat or two of French polish.

Venetian Blind.—The accompanying illustrations show an improvement in Venetian blind making. The mortises for the cord pulleys at the right hand end of the top piece should be as shown at A (Fig. 1), as then the cord will run straight to the pulley B. If it were made to run at an angle, the cord would be thrown off the pulley. The mortises should be made so that the pulleys fit closely sideways, otherwise the cords will certainly run off, become jaummed, and break. In making blinds more than 2½ ft. wide, it is usual to have three suspending tapes, as shown in Fig. 1, so as to equalise the weight of the laths, and cause the blind to keep straight. When fixing the suspending tapes to the thick lath, an easy way to keep the latter parallel with the head piece is to place two blocks, each lim, thick, between the two, as shown at C (Fig. 2). The tapes can then be pulled tight and tacked, one of the hlocks being shifted to the middle when the third tape is being fixed. The top lath to which the turning cord is fixed should be allowed in longer than the others at the left-hand end, so that the cord will hang clear of the other laths, as at D (Fig. 3). It is also best to make a trench across the top side for the cord to lie in. The cords should not be knotted, to keep the meyen; the hold-fast will serve to keep the blind at any height required without any knots.

and swill in several waters. Bind some fine iron wire on the fittings, and place them in a diluted acid bath; this will cause a thin layer of copper to be deposited. Well wash and dry in box-dust. Paint the fittings over with a mixture of blacklead and oxide of iron or rouge; brush to a polish and then lacquer. The better plan would be to clean the fittings from lacquer in the manner described in the previous column, and use a ready-prepared bronze medium, which is easily applied and gives good results.

Replacing Broken Iron Pipe in Water Main.—
To remove the broken pipe, it will be necessary to empty the main, and by means of fires lighted under the sockets of the pipes, to melt the lead out of three or four of them. A new length of pipe could then be inserted, and the joints re-made. If the lead is not very deep in the sockets, it could be chipped or cut out with a hammer and thin cross-cut chisel. Or the sockets can be cracked by using a large hammer, and then burst off by driving in a thick hand chisel. It may be necessary to expose and remove three or four of the pipes (and this is advisable), otherwise the new pipes would be difficult to place in position. Another method would be to chip round the ends of the defective pipe, or use pipe cutters, and then burst the pipe transversely by driving in a thin chisel on one side of the pipe where cut. A new length of pipe can then be inserted, and a loose collar (or a pair of loose collars if the pipe does not have a socket on one end) used for making the joints to the plain or spicket ends.

Head Screen for Photographic Portraiture.— To avoid top light in portraiture the best plan is to con-



Head Screen for Photographic Portraiture.

The cord must always be stretched before putting it in, or the blind will never hang even. The tapes should be neatly folded over each other at the bottom lath, and tacked with brass tacks. The holes for the cords in the bottom lath should be small enough for the cord to just pass through, and should be countersunk, so that the knot on the cord will sink in fush. For making the slots in the thin laths, bore two holes through the pile of laths, and cut out the wood between with a paring gouge; this is as quick as the punch, and makes a better job.

Fixing Cycle Hub Cups.—The manufacturers' process of putting in cycle hub cups is described as follows. First heat the hub case on a hot plate, press the cups in with a small screw press, fitting and bearing on the cup edgee, and plunge in water to cool before removing the tool. This is the best way of ensuring a reliable job. Some makers press the cups in cold under a screw press; this is quicker, but not so reliable. To replace a cup in an old hub, "sweat" it in with soft solder. To do this, thoroughly clean the hub and the outside of the cup till the surfaces are bright, tin the surfaces with solder and killed spirits of salts, wipe off the superfluous solder whilst hot, press the cup in position, and heat up with the blowpipe till the solder is molten, and cool off at once with water. Great care is required, in applying the heat for soldering, to avoid letting down the temper of the cup.

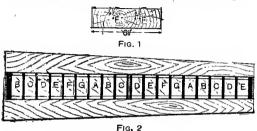
Renovating Gas Fittings.— Below is described the best method of renovating gas fittings that were once brown, bronze, and gold, and have to be treated in the same way again. Cleanse the fittings from the old lacquer and dirt by boiling for about twenty minutes in a strong solution of soda or potash. When the fittings are cleansed of lacquer, dip in a diluted acid (nitric) bath till clean from grease, and then dip in strong acid

struct a head screen, as shown in the accompanying illustration. The screen is covered at A with one thickness of muslin, and at B with two thicknesses of muslin, and is counterpoised by the weight C, which is suspended by the cord D, travelling over the pulley E. By this arrangement, the screen may be instantly placed in any position. The screen is further supported by the strut F.

Tinted White-lead Paints.—For exterior work mix white-lead paint to working consistency with 3 parts of boiled oil and 1 part of turpentine, adding 1 lb. of patent driers to each 14 lb. of white-lead. The following is a list of tints which may be obtained by mixing colours ground in oil with the white-lead. The tints may be varied somewhat by mixing in variable proportions the ingredients used in each colour. Pearl grey: White-lead 40, vermilion 3, deep green 1. Light French grey: White-lead 40, vermilion 3, lorange chrome 1. Light stone: White-lead 30, yellow ochre 1. Buff colour: White-lead 20, golden ochre 1. Light oak: White-lead 60, yellow ochre 2, raw umber 2, venetian red 1. Pale blue: White-lead 30, brunswick blue 1. Pea green: White-lead 20, light green 1. Sea green: White-lead 20, deep green 1. Salmon: White-lead 14, yellow ochre 1, venetian red 1. Slate colour: White-lead 20, lampblack 3, blue 1. When mixing the colours, blend all well together in paste form before adding the oil; otherwise the finished work will become streaky.

Diver's Dress.—A diving dress is made of water-tight canvas, rubber, or other suitable material, and envelops the whole of the diver's body and limbs. In order that the hands may be free, they sometimes project through sleeves with water-tight wrists or cuffs. The dress is secured to a brass or copper shoulder piece, and the helmet is fastened to the neck of the shoulder piece with a kind of bayonet joint. The diver is dressed in thick woollen clothing under the diving dress, and wears thick shoes with lead soles to act as ballast and keep him vertical. Sometimes pieces of lead are suspended from the shoulders. Air is supplied from a pump on the surface, and conveyed to the helmet by indiarubher tubes. A line is also attached to the dress and continued to the surface for signalling purposes. The air-valve in a diver's helmet is kept closed by a small spring and, when immersed, by the water pressure. The valve opens only when the pressure of the air inside the diving dress is greater than that of the water and the spring comgreater than that of the water and the spring com-

Glass Harmonica or Dulcimer.—A glass harmonica or dulcimer may consist of strips of plain glass, played by being struck with a beater. Take a piece of \$\frac{2}{3}\$-in, pine 1 ft. 11\frac{1}{2}\$ in, long, and 7 in. wide at one end and \$\frac{1}{2}\$ in. wide at the other end. Proceed to make a box of this hy glueing on each side a piece 1 ft. 11\frac{1}{2}\$ in. long by \$1\frac{2}{3}\$ in. wide and \$\frac{1}{2}\$ in. thick. For the wide end a piece of \$\frac{1}{2}\$ in. stuff, \$1\frac{2}{3}\$ in. long, will be required; and for the narrow end. a piece 4 in. by \$1\frac{2}{3}\$ in. These must have two slots cut in them, as shown by \$\frac{1}{2}\$ in. These slots are \$\frac{2}{3}\$ in. deep, and are \$2\$ in. from each side at the wide end, and \$1\frac{1}{2}\$ in. at the narrow one. Glue across the centre of the box a piece of wood to act as a bridge. The top of this must be \$\frac{2}{3}\$ in. below the top of the sides, and must not touch the bottom of the box. \$\frac{1}{2}\$ in. shows two small panel-pins \$\frac{2}{3}\$, one of which is inserted at a distance of \$\frac{1}{2}\$ in. below each slot. Take some strong fine



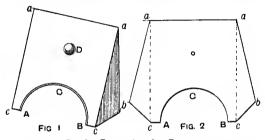
Glass Harmonica or Dulcimer.

silk or crochet cotton and tie one end securely to one of the pins. Bring the end through the slot immediately above the pin, carry it over the bridge and through the opposite slot, wind it round both panel-pins at that end, take it back again through the slots, and fasten it off securely. These strings must be stretched as tight as possible. Out the glass into strips, I in. in width, and attach them to the strings by drops of sealing wax. The box will hold eighteen strips, which should be in the key of C, and range from B to E. Before fastening in the glasses, simply place them on the strings and try them, changing them about until their proper places are found. To sharpen a note, cut the glass a trific shorter. For glass 1 in. wide and \(\frac{1}{12}\) in. thick the following will be about the correct lengths:—B, 5\(\frac{1}{2}\) in.; C, 5\(\frac{1}{2}\) in.; E, 4\(\frac{1}{2}\) in.; E, 4\(\frac{1}{2}\) in.; E, 4\(\frac{1}{2}\) in.; E, 3\(\frac{1}{2}\) in.; E, 3\(\frac{1}{2}\) in.; E, 3\(\frac{1}{2}\) in.; D, 3\(\frac{1}{2}\) in.; E, 3\(\frac{1}{2}\) in

Bicycle Home Exerciser.—A cheap and simple home exerciser to use with an ordinary rear-driving safety cycle supports the back wheel just clear of the ground. Make two wooden side frames the shape of a capital A, about 15 in. high and about 20 in. at the base. These should be connected by two stout battens at the lower ends with the corners strengthened, or the side frames may be fastened to the cross battens by stout iron hinges, which would enable theappliance to be shut up when not in use. Two iron plates about i in thick should be cut to screw on the top of the side frames, with a \(\frac{3}{2}\)-in. hole in each to go over the axle ends under the nuts. The stand should

preferably be of 2-in. by 1-in. oak, mortised and tenoned. White wood may be stained oak colour, but it would not look like oak owing to the difference of grain. If an ordinary cycle stand is placed under the front wheel, the machine will be firmly held; but failing a stand, another support similar to that described should be made to hold the front wheel. Should the machine be fitted with a back rim brake, the pressure may be regulated to any degree to make the work light or heavy; but failing a brake, a hard-wood roller, turned to fit the curvature of the tyre and mounted on an iron spindle, attached to one end of a lever fixed to the framework, may be used for regulating the pressure. A cord could be fixed to the other end of the lever, and held in the hand or tied to the top tube to obtain the required pressure.

Smoke Preventer for Range.—The smoke-preventer Fig. 1) can be made of No. 20 B.W.G. charcoal iron, and is Smoke Preventer for Ranga.—The smoke-preventer (Fig. 1) can be made of No. 20 B.W.G. charcoal iron, and is suitable for a range or for an ordinary kitchen grate. Fig. 2 shows the method of obtaining the pattern, where A B is equal to the width of fireplace, ab the upright height, and c b the projection. Angles at a, b, and c are right angles, and a is parallel to c c, also a c is atright angles to a. Bend the pattern along the dotted lines ac, until the angles at a, b, and c are at right angles to the front. This can best be done with an angle-bender, or a sharp hatchet stake will answer very well. A bead is now required for the arch a C B. Cut a length of $\frac{1}{2}$ -in, steel or hrass bead, rather longer than the circumferential measurement of the arch, and set off around the arch a series of small edges, say every 2 in., alternately opposite to each other. Bend about 6 in. of the bead carefully, with a smooth hollowing hammer on a hollowing hlock, until it assumes the same shape as a portion of the arch, and slightly open the seam of the bead, and drive it on with a mallet, tapping it frequently with the round part



Smoke Preventer for Range.

of the mallet to the shape of the arch. This should be done gently so that the bead will not be dented or otherwise injured, after which the ends are cut off level with the bottom. A hole is punched at D (Fig. 1) for a steel or brass knob which is secured by a nut and washer on the other side. The bead is burnished, and two coats of Brunswick black will give the smoke-preventer a finished

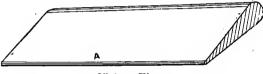
Removing Tar Stains from Carpet.—To remove tar stains from a carpet, moisten the tar with a rag wetted with benzene; as the tar dissolves, mop up the stain with a clean, dry rag. Continue the treatment until all the tar is removed.

Use of Slide Rule.—One form of slide rule may be a logarithmic scale, having really four scales, A, B, C, D. In using it for cubing quantities, as, for example, a stone heap, set 1 on C to breadth on D, and under the length on C will be the area on D. Then l on C set to area on D. In the rule is not arranged precisely in this way, the notes above may furnish a clue to the method of using the rule. A stone heap does not come under the head of ordinary cubing, as the heap is an Irregular figure. The length, breadth, and height having been measured, the contents will be $\frac{1}{2}h(A + a + \sqrt{A \times a})$, where h is height, A the area of the base, and a the area of the top. To work this slide rule, set 1 on C to the width of the base on D, and under the length of the base on C will be the area (a) on D. Then set 1 on C to the width of the base on D, and under the length of the top on C will be the area (a) on D. Next set 1 on B to the area (a) of the top on A, and under the area (a) of the bottom on B read the sq. root of the product on D. Then set 3 on C to the height (h) on D, and opposite the sum of the first three results on C will be found the total contents on D. The methods of working may sometimes be shortened after practice, but the better plan at first is to go rather a longer way round until the scale is familiar. until the scale is familiar.

Deep Brown Stain for Trellis.work.— An oil stain that will stand rain and other atmospheric influences should be used for this purpose. The stain mentioned below can be easily applied. Boiled linseed oil gall., American turpentine § gal., terebine or liquid driers ‡gal., coal-tar or deodorised naphtha l pt. Mix these ingredients well together, and use the mixture for thinning down burnt Turkey umber ground in oil; about 71b. will be required, free from lumps. This oil stain forms an excellent protection against the weather, and effectually prevents the woodwork cracking. The cest will be about 3s. per gal., and the stain may be applied with an ordinary paint brush. The stain dries with a dull surface, which may afterwards be varnished. The quantities named above will make about 2gal of the preparation.

Fixing Celluloid on Piano Keys.—For fixing celluloid on the keys of pianos and similar instruments, the finest transparent glue, with a small quantity of flake whits added, is generally used by the trade. Fish glue is useful if only a few keys require attention. The old adhesive should be scraped off, and the celluloid to be glued wiped over with methylated spirit; this will soften the surface and enable the glue to hite better. If transparent glue is used, it should be freshly made and applied quite hot, but rather thinly. The two surfaces must be tightly cramped together for several hours, and if cramps are not available the pieces may be tightly bound with string, a wooden wedge being forced between the string and celluloid to eusure closer contact. The keys must be removed from the instrument before the operation of refixing the celluloid. The surface can be repolished by well rubbing with turpentine or benzoline and finest pumice-stone powder.

Reshaping Oilstone Slip.—The edges of some oilstone slips similar in shape to the accompanying sketch, when frequently used for sharpening router cutters, etc., soon wear out of shape, especially the part marked. The shape may be restored by rubbing the oilstone



Oilstone Slip.

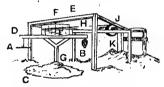
on a piece of sharp gritstone, using silver sand and water, though a grandstone, if handy, will be preferable. Le will be found better for some purposes to use the sids of the grindstone, if it be in good condition, than the edge. In this case also water and a little fine sand will be found an advantage.

Noise in Singer Sewing Machine.—In the case of a singer oscillating shuttle sewing machine which when running makes a knocking noise, once for each stitch, proceed as follows. Take the machine to pieces, well clean it, and put together again. Each part should be carefully examined, and if much worn should he repaired or duplicated. Thus undue looseness is taken out, and by running the machine as each part is fitted, any wrong action or unnecessary noise can be detected and remedied. Then when the last part is replaced, the machine will run smoothly and silently. The noises may be caused by looseness in the feed forked lever, the feed rocking and raising shafts, and by wrong position of the feed. The feed lever is situated in the vertical part of the machine arm, and is actuated by a cam, which wears a hollow in the fork; then the knocking sound is particularly noticeable when no oil is put on. To remove these hollow places, take out the lever and soften the forked end by getting it red-hot, and then close it with the hammer or by pinching in a vice until it is a trifle smaller than the cam. Then when cold place it in a vice and, with a 6-in. second-cut flat file, fit the inside of the fork to the cam, removing all file marks on the wearing surface with smooth emery cloth. Then case-harden the wearing surfaces of the fork by heating to a blood-red, dipping in prussiate of potash (powdered), heating again so as to allow the potash to boil and penetrate, and cocling off in cold water, holding the lever in a vertical position. Dipping flatways may close the fork. Finally, clean up with No. 00 emery cloth. The feed rocking and raising shafts are on the front and rear of the under side of the base. At the right-hand end of one is a fork, in which oscillates a cam connected to the shuttle rocking shaft. If this fork is worn it may cause a tapping sound. The fork is usually of cast-iron, and therefore cannot be closed as in the previous case. If a new shaft cannot be closed as in the previous case.

repaired by filing out about 1 in., and inserting a piece of steel which should be secured by riveting. If necessary, insert a piece on each proug of the fork. These plates need not be hardened, but must be well smoothed to prevent them cutting the cams. At the left-hand end of the other lever a small fork will probably be found, in which revolves a roller. Wear in this fork will also cause clicking, and must be remedied as just described. This refers to old-style machines. The feed may be adjusted sideways by the centre screws and nuts. In replacing this rocking shaft, it is sometimes fixed so as to cause the feed to hind on the side of the heedle-plate; this would also produce clicking, but could be remedied by readjusting the centre screw and nuts. All the above adjustments should be made before the shuttle is placed in the race-way. For excessive play the shuttle carrier may be closed up, but first ascertain whether this part is hardened by testing it with a file. If it is soft, simply turn the wheel of the machine until the heel of the carrier is downwards, that is near the bottom of the race-way; then place a punch of drift on the carrier heel and deal it a blow with a hammer, and repeat if necessary. There should be for ordinary purposes about \$\frac{1}{2}\$ in between the shuttle and the heel when this is in the position at which the loop pulle off, but if coarse threads are used more space is required. Any play between the handwheel and the lower shaft bearing will cause noise. If there is not much play the taper pins should be knocked out and slightly bent, so that they will take out the looseness.

Eau de Cologne Perfume.—Eau de Cologne of a kind can be made at home by dissolving 4 oz. each of lemon, bergamot, and orange peel oil in 6 gal, of rectified spirit, and adding 2 oz. each of the oils of rosemary and petite grain, and ½ oz. of oil of neroli.

Horse-gin for Lifting Ore, etc.—The accompanying illustration shows a cheap form of horse-gin for



Horse-gin for Lifting Ore.

lifting ore from a mine shaft. A is the yoke for the horse, mule, or ass, B the traditional bunch of carrots, or load to balance the weight of the yoke, C the circular track in which the animal travels, D the lever crosshead supporting the winding drum E and carried by pivots at Fand G; H is the rope passing from the drum over the gin-wheel J and down the shaft K. The other parts shown are framing to support and keep in position the whole apparatus.

Dyeing Woollen Fabrics Sage Green.—Sage green is a difficult colour to dye, and it must be remembered that the colour will be modified if the fabrics are already dyed. Dye the material in a bath containing 402. of naphthol green, 102. of suiphuric acid, 802. of ferrous sulphate, and 402. of sodium sulphate, with a very little Bismarck brown in 1 gal.; raise to the boil before removing the material. It will be best to dye a small piece of the material first as a sample and adjust the Bismarck brown to give the shade required.

Black Japan.—The following produces a black japan with good covering properties. Barbadoes asphaltum 28 lb., boiled linseed oil 1½ gal., flake litharge 1 lb., terebine ½ gal., black oxide of manganese 1 lb., powdered burnt Turkey umber 1 lb., and American spirits of turpentine 2 gal. Proceed as follows: place the asphaltum in a suitable iron or copper vessel, melt it over the fire, and add the boiled oil, which should previously have been warmed. Raise the temperature to about 400° F., and add steadily the black oxide of manganese and litharge; maintain the heat for about fifteen minutes, stirring constantly, and add the burnt Turkey umber. Then allow the temperature to drop to 200° F., and add very steadily the turpentine until it has cooled down somewhat, when it may be poured in much quicker. The terebine may then be stirred in and the varnish allowed to cool. Should it become thick when cold, warm up and add more turpentine until the right consistency is attained. The ahove varnish may be somewhat improved in quality by adding whilst it is hot, eay at 200° F., 1gal. of finest copal varnish. This japan is used for all kinds of carriage work, and dries with a brilliant finish which is quite durable.

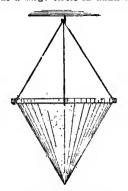
Must Warmers.—Hot-water must warmers have been made and used for a number of years, these being small plated metal flasks (about the size of an egg), fitted with a screw stopper, and filled with hot water when required for use. These flasks remain hot for a considerable time. Musts containing burning material are of metal, having a removable cover or lid, to admit of the material being inserted and the ash emptied out; the material is usually a stick-shaped piece of pithy substance that smoulders slowly when lighted. The material appears to be of a fibrous nature, ground up and shaped as required, and then probably soaked in a weak solution of saltpetre and dried.

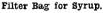
Blueing Steel.—Gun harrels, especially military and sporting ones, are black browned, but at times rook rifles and other small-bore barrels are blued. The blueing is done by immersion in charcoal. This, pounded to line powder, is placed in an iron box and made hot over a fire. The box is best made of boiler plate, the size being regulated according to the articles requiring blueing. The work to be treated must be polished to a very high pitch to get good results, and after immersion in the hot charcoal dust must be taken out from time to time and dusted with whiting well pounded to dust. This process is carried on until the work becomes of a brilliant dark blue, after which the work can be allowed to cool, wiped clean, and oiled.

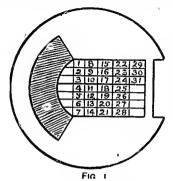
Filtering Syrups.—Syrups may be filtered through an ordinary filter hag; or a bag may be made by cutting out a large circle in fiannel and folding it till it

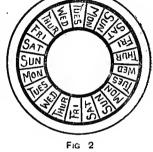
ends so that the band may be drawn up tight by one or two nutted screws (gutter bolts). Before putting the band on, prepare a mixture of red-and white-lead of the consistency of very soit putty, and thin a little of this with linseed oil to make a paint. Clean the pipe at the leaky part, paint it, paint the inside of the sheet-iron band, put a thin layer of the lead putty on the pipe, then put ou the baud and draw it up tight. The application of putty or cement, without a band, will be unsuccessful.

Watch case Perpetual Date indicator.—For making the convenient little date-indicator illustrated by Fig. 1, cut two discs of thick white notepaper to fit exactly into the back of the watch-case, and then cut another disc about \$\frac{1}{2}\$ in smaller in diameter. On the latter describe a concentric circle with a radius \$\frac{1}{2}\$ in smaller and then with the same radius describe a semicircle on one of the larger discs. Now lessen the radius by \$\frac{1}{2}\$ in, and after describing a second concentric circle on the smaller disc, as shown at Fig. 2, put a second semicircle on the front disc (see Fig. 1). The larger circle on the small disc must now be divided into seven equal parts, which, of course, will be a little less than the radius of the circle; then divide each space into three equal parts, making twenty-one in all. From each polut draw a line towards the centre, but go no farther than the circumference of the inner circle, and mark the days in rotation, that is, three complete weeks. Now, having taken with the dividers the third of the circumference of the larger semicircle on Fig. 2, set off the distance on the larger semicircle on the front disc (Fig. 1); then draw lines from the









Watch-case Perpetual Date-indicator.

forms a cone, then stitching it up one side and opening it out. It should be sewn on a ring, the ring being supported by four cords hanging from a hook in the ceiling. A sketch of the device is here given.

Boarding Walls of Damp Room.—Below is described how to cover the walls of a damp room with hoards which are then to be papered. First plug the walls with a number of wood plugs driven in the joints of the brickwork; to these plugs nail or screw wood battens, 2in. by 4-in., about 2 ft. apart. Then with ordinary cut nails fasten to the wood batten 1-in. by 41-in. matched boarding, and over this tightly stretch canvas called scrym, tacking it on the edges and down the centre with tinned tacks. The edges may be laid with strong glue. Cover the canvas with continuous brown paper, or preferably with Willesden waterproof two-ply paper, and finally cover with a pattern or an ingrain paper. Ordinary paperhanger's paste, composed of flour and water with a little alum added, may be used to hang the papers.

Dyeing Lace Curtains Yellowish Green.—Saffron is used to give a yellow tint to lace curtains: but, however, its use proves to he very expensive. There are no stated proportions; a small quantity is boiled with water, strained, and then added to the starch. A cheaper way is to dissolve a little picric acid in water to form a yellow liquid, then add a very small quantity of laundry blue (deep shade) until the colour is sufficiently green, and add this to the starch in which the curtains are dipped.

Repairing Leaky Hot-water Pipe.—In the case of a hot-water pipe in a hot-house leaking slightly, no hole being visible, the application of some external remedy should prove successful in stopping the leak, as the pressure is very low. If the leak is at a joint the only proper remedy will be to repack the joint thoroughly: if at a plain part of the pipe, bend a strip of sheet iron to form a strap or belt round the pipe, and have holes at the

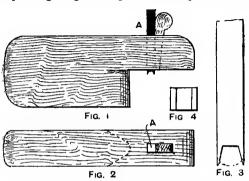
extremities of this arc towards the centre, finishing where they cut the smaller semicircle. Remove the shaded portion, and the opening should expose seven days when placed over the smaller discs. Next rule eight equidistant horizontal lines between the ends of the smaller arc on the face of the front disc, and put in six parallel perpendiculars, which may be either equidistant or graduated in accordance with the size of the figures they will eventually contain. Mark thirty-one consecutive numbers in the spaces, cut away a small piece from the right-hand side of the disc, and remove a similar piece from the other large disc, which constitutes the back portion of the indicator. Insert the smaller disc between the two large discs, and fasten together the edges of the two outer circles, taking care not to interfere, with the smaller disc, which must be left quite free; and, lastly, fix the indicator inside the watch-case, using Seccotine or any other good adhesive. On the first duy of each month the inner disc can be rotated by means of a pin point until the day that begins the month heads the visible series. If made of cardboard instead of paper, the date-indicator would be suitable for carrying in the waistcoat pocket; and for using in this way, the smaller disc (Fig. 2) could be inclosed by squares, oblongs, or ovals, in place of the two circles.

Röntgen Ray Photography.—A Röntgen ray photograph of the whole of a man's body has heen produced, but an exceptionally powerful induction coil and a large Crookes tube are required. Even then the photograph must he taken in sections and fitted together afterwards, as some portions of the body (being thicker) will require a longer exposure than other parts. The limbs, of course, require much less exposure than the trunk. The plate should be a very rapid one, but need not be specially prepared, as the silver bromide is decomposed by the Röntgen rays in the same way as by ordinary light, the image appearing on development. Röntgen rays are not refracted by an ordinary lens, and therefore an image through the camera is impossible.

Marbling and Varnishing a Bath Top.—Below are instructions on painting, marbling, and varnishing a bath top. Remove all traces of soap, dirt, etc., by means of strong soda-water and a scrubning brush, rubbing down all insqualities with pumicestone: then rinse down with cold water. After leaving the bath top several days to dry, apply a priming coat of paint made by mixing together equal parts of genuine white and red-lead thinned down with boiled oil 3 parts and turpentine I part. Allow ample time to dry, then apply the ground colour mixed in equal parts of boiled oil and turps. Now moisten a long feather with turpentine and place on it one or two paints of the colours to be imitated and draw the feather across the work in various directions until the desired pattern is obtained. Allow to dry, then give two coats of hard copal varnish; the first coat must be thoroughly dry before applying the second. This will give the hath top a hard glossy appearance that will not be affected by the soap.

appearance that will not be affected by the soap.

Tool for Purfling Violins.—To make a purfling tool used in violin making, take a piece of hardwood about 4 in. long, ½ in. broad, and ¾ in. thick, and shape it as Figs. 1 and 2. The cutter A may be made from a piece of steel about 2 in: long cut from a joiner's nail-punch. File the steel parallel, and with a thin ward file cut a groove about ¾ in. deep in one end, forming a double cutter as Fig. 3, taking care that the over-all size is just the width of the purfling. A side view of the end is circular as shown by dotted lines. The cutter should be filed up sharp with a fine file, but will cut cleaner and keep its edge longer if tempered and set up with a thin



Tool for Purfling Violins.

slip of oilstone. After the double cnt (which must be uone with a firm hand) is made all round the violin tables, the groove is cleaned out with a narrow chisel or a sharp bradawl. Fig. 4 is a plan of the cutter looking upwards.

upwards.

Removing Mainspring from Geneva Watch.—The correct method of taking the mainspring out of a Geneva watch is as follows. For a bar movement, unscrew the barrel bar and take it out. Take off the stopwork under the barrel. The stop finger may be punned on or may be pushed on friction tight only. Insert a screwdriver blade, and prize up the barrel cover. The mainspring can then be pulled out. If the watch has a three-quarter plate, ake off the hands and dial first, theu knock out the sethands arbor from the front, take off the top plate, and the barrel can then be removed. If the old spring is not broken, the barrel bar, or plate, must not be removed without first letting the spring down. This is done by placing a key on the winding square and holding back the click, allowing the key to run back steadily in the fingers.

Scheme of Colour for Sitting-room.—An effective

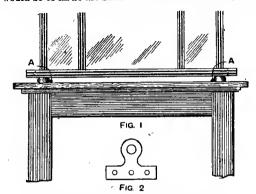
steadily in the fingers.

Scheme of Colour for Sitting-room.—An effective scheme of colour for woodwork and cornice of a sitting-room is required for a paper having a bright sage green, with flowers and leaves worked in two lighter shades of the same colour. Two metbods, both in harmony with the paper, may be adopted. The woodwork may be painted in the colours of the wallpaper; the panels, sashes of windows, etc., being of the lightest colour, the stiles of the door and window and the frames painted the medium colour, and the skirting, mouldings of panels, and edge of architraves painted in the darkest shade in the paper. The better plan would be to make harmony by contrast. Paint the woodwork a warm terra-cotta, which would provide the colour that is lacking in the paper. The tone for the panels need not be of greater depth than the lightest colour in the paper, the medium colour for the frame of the panels should be a little richer, and the skirting and mouldings in

creased in depth. If there is any small half-round bead or flat on the moulding next to the panels, this bead or flat would look very effective if gilded; for gold possesses the subtle property of harmonising with all colours. Whatever may be the colour of the woodwork, the coruice must be carried out in a similar way. The hollow parts receive the darker colours, and by placing lighter tones upon the prominent members the ornament is increased in strength. Yellow ochre and burnt sienna, with a little chrome (medlum No. 2) make an effective terra-cotta colour when added to the white-lead

Artificial Thumb.—No artificial thumb could be substituted for a lost thumb, as the human hand is carried without clothing. An artificial thumb would therefore attract more attention than the stump of the amputated member. A leather glove with a padded terminal to the thumb would be one of the most effectual disguised substitutes. Next to this would be a leather thumb-stall padded with chamois leather or with rubber, and secured to the wrist with a leather strap.

Fixing Temporary Mantelboard.—The following is a simple method of fixing a temporary mantelboard to a mantelpiece. The board is placed on the mantelpiece and kept in position by two brass-headed nails A driven into the wall close to the feet of the overmantel as shown. The weight on the board is sufficient with the nails to prevent the mantelpoard shifting. Another method would be to fix at the back of the board two brass plates



Fixing Temporary Mantelboard.

(Fig. 2), which could then be nailed to the wall near the feet as before. This method would prevent any side play. The nails A can be driven into the wall so as to be almost out of sight.

Mending Pneumatic Tyre.—If the fabric of a pneumatic tyre is rotten at the point where the tyre bulges over the rim, strip the cover from the wheel, turn it insids out, thoroughly dry and clean it, and solution a piece of new prepared canvas over the bad part. Let the patch be the full width of the cover if the bad place is of any size; and it will greatly strengthen the job if sewn at the edges near the wires or beaded edgs. Allow the solution to remain for half an hour or more before laying on the patch. When dry, replace the cover on the wheel, blow up, and repair the rubber part if necessary to keep out the wet and dust, with patching rubber solutioned on. Clean the rubber of the cover and the patch with benzoline before applying the solution.

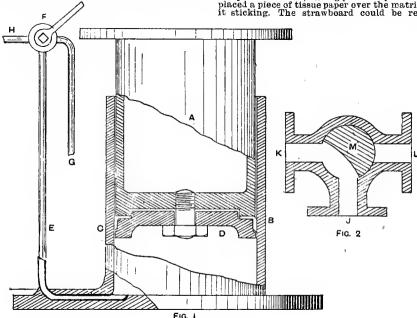
Tinning Cast-iron.—When cast-iron for soft-soldering is to be tinned, the oxidised surface is filed off and the iron tinned by using killed spirit as a flux, but strong, reliable joints on cast-iron cannot be made with soft solder. Such joints may be made to appear as satisfactory, but the iron will eventually leave the solder. Small castings that are to be tinned all over must be first tboroughly cleaned and then pickled by immersion in dilute sulphuric acid, and afterwards scrubbed or scoured perfectly clean with sand and water and a very hard brush. In some cases a further immersion in the acid is necessary, in order to loosen the scale. When the iron is perfectly clean, it should be pickled in a solution of chloride of zinc (killed spirit) and sal-ammoniac, and then dipped in molten tin and held there until the iron has acquired the same temperature as the tin. Any places left uncoated after the dipping should be rubbed with sal-ammoniac and again dipped. The tin should not be too highly heated, but the temperature should be such that any superflucus tin drains off when the iron is taken out of the pot.

Shortening Wire of Pnonmatic Tyre,—It sometimes happens that the wires in the edges of a cycle tyre cover are a little too long, so that when the tyre is inflated the cover has a tendency to move over some part of the rim. To remedy this, repairers often solution, and even sew, a "welt" of canvas all round outside the wire in order to tighten the cover. This is a formidable task, and a simple plan is to give the wire a very slight bend at intervals of about 1 in. or more, thereby making it slightly zig-zag, and, of course, shorter. This can be effected by means of flat-nosed pliers without injury to fabric or rubber.

Hydraulic Lift.—Fig. 1 of the accompanying illustrations shows the general arrangement of a lift, but not to seglo. The ram A is a hollow casting, the cylinder B is also of castiron, and at the bottom to make a watertight joint is a leather cup C secured with the disc, stud, and nut D. E is the inlet pipe, F a three-way cock, G the exhaust pipe which may lead to a drain, and H the supply pipe from the tank. In Fig. 2, which is a section of the cock, J is the inlet to the cylinder, K the supply gipe from the tank, L the exhaust pipe, and M the

 $\frac{168+3.75}{18}=\frac{171.75}{18}=9.51~\rm sq.~in.;~therefore~a~ram~having~a~diameter~of~3½~in.~will~be~sufficient.~If~the~ram~falls~too~rapidly,~a~diaphragm~with~a~small~hole~may~be~placed~in~the~exhaust~plpe.~A~l-in.~steam~pipe~will~be~large~enough,~and~the~tank~may~be~of~any~size,~for~this~does~not~control~the~pressure.$

Die for Paper Embossing Press.—For embossing cards in. or more the best plau would be to have two dice (a male and female die), as it is doubtful whether any composition would be hard enough to throw up the board, and at the same time withstand the pressure. A matrix made of guttapercha might be tried, having a foundation of strawboard. Procure a good strawboard, and work up an impression of the die on it in the embossing press. Then have a sheet of guttapercha of sufficient size to cover the engraving on the die, heat one surface of it over a gas flame, and at the same time heat the embossed side of the strawboard and place the guttapercha on it, and work over it carefully with the fingers so as to ensure it sticking to the strawboard. Now put this into the press again, and work it up with the die, having previously wetted the die, or placed a piece of tissue paper over the matrix to prevent it sticking. The strawboard could be replaced with



Hydraulic Lift,

movable plug. This section shows the position of the plug when the ram is rising; on turning the plug so that the waterway is across the pipes J and L, the water will exhaust and allow the ram to fall. In Fig. 1 the ram is rising; it may be stopped by turning the lever upright, and the ram lowered by turning the lever upright, and the ram may be stopped automatically when it reaches the top by arranging a link motion from the table to the lever of the three-way cock. Assume that about 112 lb is to be raised to a height of 12.in. The data necessary to calculate the cylinder diameter are the waterpressure and the maximum load to be lifted. The pressure P in lb. per square inch equals the head, or the height of the tank in feet above the ram multiplied by 0.433. The area of the ram = $\frac{W}{P} \times \frac{W_1}{84}$ where W is the load in lb. to be lifted and W, the weight of ram and table. To overcome the friction of the leather cup. the ram must be a little larger than found by the above rule. The total friction $F = D \times P \times C$, where $D = \frac{1}{2} + \frac{1}{2} +$

ordinary sole leather; this would not be so liable to burst as the strawboard. Printers' flong would not wear well, and is really a mixture of flour paste and plaster-of-Paris laid between two sheets of casing paper. It could be beaten into the die with a brush as in the process of stereotyping, and when hard and dry worked up in the embossing press.

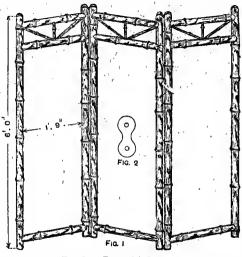
Dyeing Lignum-Vitæ Black Colour.—French black ebony water stain serves capitally as a foundation stain. Polishers rarely rely on stains alone, using spirit dye, gas black, or Frankfort black in the polish till an even colouris gained; then finish off with white or transparent polish. Lignum-vitæ as a hard wood requires a strong penetrating stain, which should be laid on hot. Should difficulty be experienced in obtaining the ready-made stain, try the following. Boil in an old iron pot strong vinegar 2 qt., extract of logwood 11h., copperas 4 oz., China blue 2 oz., and nut gall loz. Apply rather liberally, or, better still, steep the articles in the liquor. When this stain is nearly dry brush over with an iron solution made by steeping for several days rusty iron turnings, nails, or old iron in common vinegar.

Removing Paint from Head of Bass Drum.—Paint can be removed from the parchment skin of a bass drum with turpentine if the paint has not gone through the skin. A small piece of the skin should be worked on at a time. The heads may be cleaned with soap and cold water applied with a soft flannel.

Pine Fibre or Wood Wool for Stuffing Furniture.

—Pine fibre or wood wool is nothing more than fine shavings cut up by automatic machinery. The chief objections to its use for furniture stnifings are want of elasticity, which soon causes the coverings to sag, and the crackling noise made when the material is sat on. It is suitable only for the very cheapest kitchen furniture and rout seats, and its principal use is for mattress fillings for hot climates and for packing purposes. It certainly is not to be advised for stuffing drawing-roun furniture. A more suitable stuffing for this purpose will be alva or Algerian fibre cased with hair, or mill puffs (cotton flocks) coated with hair.

Bamboo Draught Screen.—Fig. 1 illustrates a threefold draught screen which is serviceable, light, and sanitary. When intended as a bed screen for hospital or sickroom purposes, an extra fold should be added. The uprights should be of 1½-in. humboo, 6ft. long, and the rails may be 1½ in. thick by 1ft. 9 in. long, measuring from the hollow of the mortised ends, thus making each fold 2ft. wide over-all. One rail is dowelled into the uprights lin. from the bottom, one lin. from the top, and a 3-in. space is allowed between the top rail and the one below it, the centre spindle of ½-in. bamboo being let into the rails direct before the frame is glued up. It is most important that each frame should be quite square, which is ascertained by measuring across the corners of the open space. The slant pieces are then fitted and fixed with glue and pins in the usual way. The top and



Bamboo Draught Screen.

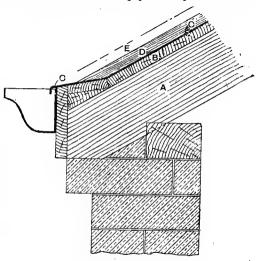
bottom ends of the uprights will require neatly plugging with wood for the hinges, which are made of hin. brass to the shape shown in Fig. 2. They are 3½ in. long by 1½ in. wide, the holes being drilled central, and the two hinges that are used for the bottom must be countersunk to allow the screwheads to go well below the surface of the brass, 1½ in. No. 8 screws being used. The top ends of the screen are finished with turned wood terminals, four of which must be bored for the screws which pass through them and through the holes in the hinges, the other two being glued on and sprigged. A curtain of strong washable material is fitted to stretch from the bottom to the second rails and the full width of the screen. Small brass hooks about 4 in. apurt are put along one side of the rails, and rings are fastened on the curtain to match. The screen should have a coat of brown hard spirit varnish, applied in a warm room.

Brown Soap.—To make I cwt. of brown soap a pan of about 4cwt. capacity will be required. In it should be placed 701b. of oils, say 301b. of cotton-seed oil, 201b. of palm oil, and 201b. of tallow. The oils must be heated until the tallow melts, then a portion of the caustic sodalye must be added and the mixture brought to the boil; then when the soda is thoroughly incorporated another lot must be added, and this should be coutinued until nearly all the lye is in. The pan must now be left for an hour, and then salt should be added to throw out the soap, and the pan covered up for the night. In the morning the waste lye must be run off from the bottom of the pan, the soap must again be heated, and the little remaining sodalye added. When the action is completed the soap will appear homogeneous on the

paddle, and will dissolve readily in water without greasiness. At this point a small quantity of a brown soap colour must be added and stirred in, and the soap then run into the mould. The amount of canstic soda required for 70 lb. of oils is 11 lb. to 12 lb., and 14 gal, of water will be needed for dissolving the canstic soda to form the lye. In making a soap of this kind on the large scele, resin would also be used, and probably some silicate of soda to cheapen it; but in order to simplify the formula these have not been introduced.

Burnishing Lead Pipes.—For burnishing lead pipe for exhibition work, the burnish to be permanent, an ordinary half-round file ground down to take off the teeth, or a bar of round steel, or a bossing stick made of hard boxwood, could be used. The tool should be made bright and smooth, and if it does not elip freely over the lead a little bit of touch can be rubbed on. The lead must be afterwards rubbed the long way of the pipe with the woolly side of a piece of Brussels carret.

Remedy for Leaky Roofs.—Leaky roofs are often the result of bad workmanship and materials, though sometimes a broken slate or tile is the cause of the trouble. The method shown in the illustration is found to work very effectually. On the rafters 4 ½-in. rough boarding B is laid, and then Willesden roofing paper or roofing felt C is fixed. This paper must be carried well under all flashings, etc., and dressed into gutters as shown in section. On this paper 2-in. by 1-in. battens D



Remedy for Leaky Roofs.

are fixed down the slope of the roof, one over each ratter, and on these the battens E to receive the roofing material are fixed. The 2-in, by 1-in, battens are necessary in order that any water may have a free course down the paper into the gutters, and thus regain its proper place. Willesden paper is claimed to have a longer period of efficiency than felt.

White Enamelling Madeira Chairs.—Carefully remove all inequalities from the work by rubbing with No. 0 sandpaper, and then apply two coats of zinc white priming paint, which is made by mixing together 21b. of zinc white ground in turpentine with 10 oz. pale japan gold-size and a little turpentine to reduce the paint to working consistency. When the work is dry and perfectly flat or smooth, apply a coat of best white finishing enamel. The gold band may be run in with a coachpainter's sable liner brush, using gold bronze paint. If a better gold finish is required, gold leaf may be used in the manner described below. Allow the enamel about four days to thoroughly harden, then make some egg size by beating up the white of an egg in a glass of cold water; coat the enamelled surface with this size, using a clean brush, allow a few minutes for the size to dry, and then dust it over with French chalk, using for the purpose a soft pad. Paint in the lines and other decorative work with gold-size, then apply the gold leaf. Allow sufficient time for the gilding to harden, then wash the whole surface lightly with warm water and sponge, which will remove the French chalk and egg size and leave the gold leaf a coat of Nelson's gelatine slze in order to prevent tarnishing.

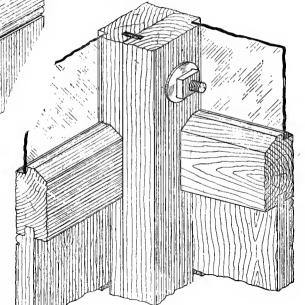
Treating Knots in Wood .- The only sound process Treating Knots in Wood.—The only sound process of destroying knots in wood is to cut them out and plug the cavity or hole by glueing in a piece of wood, or fill the holes up with hard stopping. This is the only sure remedy in cases where the wood is much exposed to the sun. A coat of red-lead mixed with weak glue and overlaid with gold leaf might be tried. and ought to prevent the knots being seen for some time. Patent knotting (shellac solution) answers in most cases, but fails on some occasions. some occasions.

Fastening Angle Posts of Portable Greenhouse.— In constructing a spau-roof greenhouse that will have to be taken to pieces and put up several times, the angle posts may be arranged as follows. Fig. 1 repre-sents a portion of an ontside angle, and Fig. 2 the inside portion. It will be seen that the posts are formed of two parts, one part being framed to the rail for the

ass, mule, and sheep. For fine grade violin strings, alum is used in the alkaline solutions in which the skins are steeped; these are drawn several times through a thicknessing appliance known as a thimble, then treated to the action of burning sulphur, which acts as a bleaching agent and prevents putrefaction of any extraneous animal fat or matter that may accidentally adhere. The strings are then pollshed by friction between horsehair cords, and dried in a hot room. Wire-covered strings require the sid of special machines. the aid of special machinery.

Resin Spirit.—Resin spirit is the lighter portion of the distillate of resin. Ordinary resin is distilled in an iron retort and vapour, and inflammable gases pass over; these are followed by a light spirit, then heavier resin tolls pass over, and a pitch or coke remains in the retort. The resin spirit is usually rectified, the portion having the lowest holling point being kept as spirit, and the remainder going along with the oils, which are used for preparing resin greases for lubricating purposes

Black Paint for Engines.—The ordinary black paint possesses poor drying properties, and would be easily removed after being saturated with oils, etc. The finest black japans are most suitable for this class of work, and will stand a temperature of 300° F. to 400° F., drying hard with a glossy surface that will not be affected by the oil or heat. For cheaper work Brunswick black may be used, also drop black ground in turpentine with one-third of its bulk of japan gold-size; this is applied as in paint and allowed to dry, when it is finished with a coat of hard copal varnish. For coloured pigments for this work, ensmel or varnish paints will be most satisfactory. As sub-



Fastening Angle Posts of Portable Greenhouse.

Fig. J

sides, and the other to the end. These posts can be fastened together by bolts and nuts as illus-trated. To keep out the draught they may be ploughed and a tongue inserted.

Hardening Cycle Cones.—Most cycle cones are made from a special brand of steel that will harden direct in water or oil. With this class of steel, heat gradually on a clear fire or with a brazing blowpipe to a cherry red and plunge into a bath of water having about 2in. of oil on its surface. If the steel will not harden thus, nse water only. Another class of steel used for cone making (especially on automatics) is very soit, and easily worked; this will not harden direct in water or oil, but must be case-hardened. If a large number of cones are to he treated, pack them with bone dust or leather cuttings in an iron box, heat up the lot in a furnace for an hour or two, then empty the contents into cold water. If only one or two cones are to be treated, use yellow prussiate of potash. Heat the cone, rub in the potash, heat again and repeat, and then plunge in cold water.

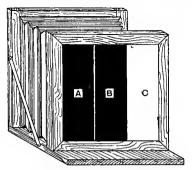
Violin Strings.—Violin strings imported from Naples and Milan are generally considered the best, being clear, elastic, and strong. There is no particular secret about their manufacture, the larger coarse gut being worked up for clock weights and machine banding, the next grade for double basses and cellos, and then grades for violin strings. One of the chief causes of success is said to lie in the fact that they are made from small lean sheep. The term "catgut" is misleading, and generally applies to membranous substances obtained from the intestines of animals, such as the horse,

stitutes, mix ordinary paste paints to working consistency with 6 parts of copal varnish and 1 part terebine. All work of this description should be carefully cleaned down with henzoline or naphtha to remove all traces of grease or oil, otherwise the paint will not adhere.

Rendering Violin Silent.—To render an ordinary violin nearly silent for practising, make a bridge of bone or ivory, of the ordinary pattern, but not perforated. Make the feet rather wider than usual, and glue a piece of kid under them to protect the soft wood of the violin belly. Use in addition to this a rather heavy metal mute, and if this does not suffice, further dull the sound by pasting pieces of paper over the soundholes or stuff the holes with cotton-wool. If these plans are carried out no serious alteration is involved, and the violin can be restored to its former power in a few minutes if required.

Bath Enamels.—In preparing bath enamels, the finest copal gums and varnishes are selected, and tempered with suitable clarified oils. The following, if prepared from pale durable copal varnish, answers admirably as a white enamel. Obtain 61b of pure zinc white ground in varnish, 6; pt. of extra pale copal varnish, pt. japan gold-size (pale); pt. pale terehine, and † pt. turpeutine. Mix the zinc white with the varnish, the whole when finished being free from lumps. Warm the preparation over a fire until very fluid, then add the gold-size, terehine, and turpentine in order, stirring thoroughly during the operation. If on cooling the enamel should thicken, add equal parts of varnish and turpentine. To tint the above enamel, obtain pure colours in collapsible tubes and thin down with turpentine, finally adding to the enamel, which should be thoroughly stirred. One pound of colour added to each gallon of enamel will have no injurious effect; but the proportion should in no circumstances be exceeded, otherwise the enamel will not resist the hot water.

Trick Photography.—For producing three photographs of the same person on one plate, showing, for example, three persons playing at cards but the same individual posing for each of the three figures, two cards are placed in the camera bellows as shown, and the cards are moved and the figure is rearranged for each exposure. The illustration shows the camera ready for use, A and B being two card strips covered with dull black paper. In the position the cards now occupy the



Apparatus for Trick Photography.

apace C is left open and the figure is posed to occupy this space; the card B is then pushed along to occupy the space C, and the figure is posed so as to occupy the space B. After this second exposure the card A is moved along to the position B and the figure is posed in the apace A. Take the greatest care to prevent the figures overlapping and to get exactly equal exposures.

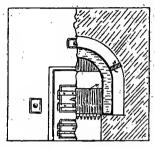
apace A. Take the greatest care to prevent the figures overlapping and to get exactly equal exposures.

Fireworks: Rockets.—Rocket cases are of cartridge or brown paper, which is cut to size and rolled aeveral times around a former or round ruler, when the edge is pasted and fastened. Sheets of paper are added and rolled on until the case is thick enough. One end of the rocket case is then damped and choked or partly closed by winding a cord around it near the end, and pulling backwarda and forwards several times until the case is sufficiently compressed. The rocket case is now placed in a wooden or brase mould which has a tapering brass wire at the bottom, and the constricted opening of the case is pressed on this wire, leaving the open end upwards. A rammer is forced in the case while the paste is atill moist, thus consolidating it and rendering it perfectly cylindrical. The case is then taken out and placed in a warm room to dry. The composition used for filling the rockets consists of barts of saltpetre, 3 parts of charcoal, and 2 parts of sulphur, which are aeparately powdered and mixed by hand. For filling, the dry cases are placed in the moulds as before, a little of the composition is placed in aud forced down with the rammer, more composition is rammed in until the material reaches to the top of the brass wire, then a place of soft paper is forced in, and several holes are drilled through it with a brass wire. The upper part of the rocket is the head or "pot," in which the star composition is placed. The stars are placed in small cardboard cases somewhat like small pill boxes; these are packed with meal guupowder into the lead of the rocket, which is theu glued up, and usually has a small come of wood fixed in it to assist the ascent of the rocket. The rocket is then removed from the mould and primed by filling the hole left by the brass wire with gunpowder made into a paste with gum-water, and a piece of touch-paper is pasted over the mouth of the rocket and screwed up into a nipple. The rocket is the

should be tied on with the teuch-paper downwards. For brilliant stars, take nitre 11b., sulphur \$1b., sulphide of antimony \$1b., and meal powder 3 oz. For crimeon stars, take atrontium nitrate 36 parts, sulphur 10 parts, guupowder 3 parts, and coaldust 1 part. For green stars, take chlorate of potash 14 parts, barium nitrate 6 parts, sulphur 17 parts, and mastic \$1 part. For yellow stars, take chlorate of potash 15 parts, dried aoda ash 6 parts, and sulphur \$1 parts. For blue stars, take chlorate of potash 4 parts, aulphide of copper 3 parts, Chertier's copper 2 parts, and sulphur 2 parts.

Disinfecting Contents of Cesspit.—To entirely deatroy the stench arising from a cesapit containing foul scap-suda will be a long and tedious job. A pound or two of crystals of permanganate of potash dissolved in water, and then poured in and mixed with the scap-suds, may reduce the stench a little. Corrosive sublimate or bichloride of mercury, carbolic acid, or a gallon or two of Burnett's fluid could also be tried. Dry powders would not be so good as liquid disinfectants.

Fixing Saddle Boiler.—In the usual method of fixing a saddle boiler, as shown, the brickwork is first built up as high as the ashpit is required to be. The fire bars and dead plate are then put in, and the boiler is placed in position. The brickwork is then continued up, leaving a 3-in. to 4-in. flue on each side of the boiler (the width of flue being according to the size of the boiler). Some fixers do not arch the flue over the top of the boiler, but this is the best and most workmanlike plan, and is easily done. When the side brickwork is up as high as the springing of the arch, put the mid-feathers



Fixing Saddle Boiler.

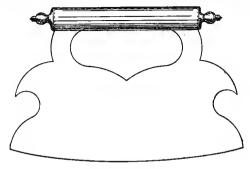
in where shown (these may be stone or cast-iron), and then cover the top of the boiler with ashes or dry sand to the thickness of the flue. The brickwork arch can then be built on this, and, when finished, the ashes or sand raked out. Three aweeping doors have to be put in the front brickwork, two coming at the lowest points of the side flues, and one on the crown of the top flue. At the back of the fire-box there is a brickwork bridge built up about half the height of the boiler, the flame and heated gases passing over this, and coming round the sides of the boiler, travelling towards the front heneath the mid-feathers. Having come to the front, the heat passes to the flue above the mid-feathers the mid-feathers ending about 6in. short of the front to admit of this), and then, travelling to the rear again over the top of the boiler, the heated gases reach the chimney. Two arrows are shown, one indicating the passage of heat from the fire-box over the bridge, and turning into the side flue beneath the mid-feather, while the other indicates the passage of the heat from the lower to the upper flue around the short front end of the feather. Care must be taken to fix the furnace front accurally, or it will quickly become loose (the doors are always opened and shut by kicking them). Let two stout pleese of iron rod or bar be connected to the front, and pass from there down, one on each side of the boiler, and clip round the end of the boiler. This is the only way to secure a sound fitting front.

Tempering Cycle Saddle Springs.—The following notes give information on tempering the spring of a cycle saddle. In hardening and tempering much depends on the nature of the steel, scarcely any two makers turning out exactly the same grade. A good plan is to test a piece roughly bent to near the shape of the spring, before treating the finished article. The following will probably give satisfaction. Heat the spring gradually to a dull red on a clear fire or with a blowpipe, plunge in soft water with the chill off, dry and heat in a bunsen burner or ordinary gas flame, and "flare off": that is, when sufficiently hot, rub some fat or thick oil all over the apring and let it burn off. The spring should be just hot enough to set light to the fat or oil. This may be done two or three times according to the thickness of the steel.

Method of Squaring Dimensions.—Dimensions are squared chiefly by the system of duodecimals, but generally the quantity surveyor does not adhere very closely to exact rules. In order to square 3ft. 6in. by 4ft. 6in., put them down one under the other; say 4 times 6 = 24 = 2ft., 4 times 3 = 12 and 2 are 14, putting down 14ft. Then to multiply by the 6in., divide by 2; thus, 2 into 3ft. 6in. = 1ft. 9in., which, put under the 14 and added, makes 15ft. 9in., the result. To square 3ft. 6in. by 4ft. 6in. works as follows.

Here, first multiply by 4, then for the 6 in. divide by 2, which is the same as multiplying by \(\frac{1}{2} ft \). For the \(\frac{1}{2} in. \) or 9 parts, imagine the amount broken up into 6 and 3 parts, then to multiply by 6 parts will be the same as multiplying by 6 in. shifted one place to the right. Then as 3 parts are the half of 6, divide the line showing the value of 6 parts by 2.

Suet Chopper. — The illustration shows a design for a suet chopper. This article can be made very cheaply. It consists of a piece of steel plate (a piece of



Suet Chopper.

a broken saw will answer very well) mounted with a brass handle. Soften the steel, mark out the pattern, cut it out, and file it up. Chamfer the cutting edge on each side, and suitably temper it again. If convenient, touch it up on an emery-wheel or grindstone, and grind the cutting edge. The handle is a piece of sheet-orass, bent to form a tube about \(\frac{1}{2}\) in in diameter. The top edge of the steel is well tinned, which is a comparatively easy task if done immediately after the grinding, and the brass tube is pushed on and soldered strongly to it. Two small brass knobs, if soldered at the ends of the handle, improve the appearance. Scrape and file off all superfluous solder, clean well with emery-cloth, and burnish with a steel burnisher.

Wheel Greases.—The wheel greases or lubricants tabulated below are suitable for all kinds of vehicles, and they are manufactured simply and cheaply. The base used principally is resin oil, a product obtained by the distillation of resin.

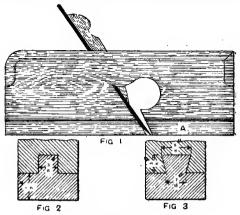
| | | | . 1- | —2 - | 3 |
|-----------------------------|-----|-----|----------|-------------|---------|
| Crude resin oil | | | 100 | 100 | 100 |
| Heavy mineral oil | ••• | *** | 30 25 | 30 | |
| China clay Lime (slaked) | | | 10 | 10 | 9 |
| Soda solution 25° T. | | | 10 | | 10 |
| Blacklead (plumbago) | | } | | | 7 26 |
| Cylinder oil Water | , | | | 5 | 26 |
| water | ••• | | | U | |

The method adopted in preparing these greases on a large scale is as follows. First slake the lime and pass it through a sieve to remove flut and other gritty matter. The oils are then placed in an iron vessel and heated together. The china clay, lime, and le d are then added, and the whole is thoroughly stirred into a

uniform mixture, when it is run into suitable packages and allowed to cool down for use. These greases are occasionally reduced or adulterated with French chalk, mica, whiting, and barytes, which should be well stirred in whilst the whole is finid. The common varieties of grease may be made by simply mixing together newly slaked lime and resin oil, and the se oud relipe may be prepared without heat, the ingredients being simply mixed thoroughly.

Oil Oak Stain.—The following is an approved recipe for a light cak stain. Mix together 5 parts of raw sienna in oil and l part of burnt Turkey umber. For a dark cak, mix 2 parts of raw sienna, 2 parts of burnt Turkey umber, and 1 part of burnt sienna. Thin down to the required consistency with 4 parts of turpentine and 1 part of terebine. All the pigments should be obtained ground in linsed oil. By mixing the colours in variable proportions, almost any shade of cak may be obtained. It is assumed that the work is to be alterwards varnished.

Renewing Sole of Rebate Plane.—When a rebate plane is worn down somewhat it may be renewed by thting on a sole piece A (Fig. 1) of boxwood or lignum-vitæ about in thick. This should be in one piece, and the



Renewing Sole of Rebate Plane.

mouth carefully cut out afterwards. It may be simply-glued and additionally secured with two screws, or it may be shoulder boxed as in Fig. 2, or dovetall boxed as in Fig. 3, \(\frac{1}{2} \) in. being added to the thickness for the tongue. In the last case the dovetail cuts are made with a sharptenon saw, and the core is removed with plough and chisel.

Cementing Cracked Earthenware Sinks.—Sulphurhas been proved by experience to be the best material for mending cracked earthenware. The sulphur should be melted, not too fast, over a bright fire in an iron pot or ladle or crucible and poured into the cracks. When melted the sulphur is of a brownish colour and is scarcely noticeable in certain light brown ware, but the addition of a little graphite will render the sulphur darker. Another cement may be made by melting 2 parts of resin and stirring in about half as much plaster-of-Paris, which must be perfectly dry. The addition of a little burnt umber will darken this cement so as to make the join leas noticeable.

Metals suitable for Acetylene Generators.—Although copperissafe for a calcium carbide chamber undercertain special conditions, it may, as ordinarily used, bring about the formation of an explosive compound, and this is so probable that the rule is not to use copper in any part of an acetylene plant. Brass, as yet has been freely used for brackets and cocksonly. Some hesitation must be felt in saying that brass may be used to make a carbide chamber, and there seems no occasion for it when tinned or galvanised sheet-iron or zine can be used just as easily, and more cheaply.

Fastening Tips on Billiard Cues.—A suitable cement for fastening tips on billiard cues may be made by covering gelatine with strong acetic acid and after a few hours melting down by a gentle heat. The cement must be applied while still warm, and the cues should be allowed to stand aside for a day or two till it hardens.

Colouring and Tabletting Chloride of Calcium.—Below are instructions on colouring and tabletting chloride of calcium. This is obtained in the state of powder, and should be rapidly mixed with the aniline dye in powder, then damped with water, and compressed into the moulds by means of a powerful screw press. If difficulty is experienced in procuring a press, place the mixture in a pewter or earthenware jug with a spout, and pour on the mixture about half its weight of hot water; the water will boil vigorously owing to the heat given out when the chloride dissolves, so be careful not to get scalded. When the solution is completed, pour the mixture into tinplate moulds, and put them in a cold place for a few hours. The chloride will crystallise to hard cakes in a short time. Colouring and Tabletting Chloride of Calcium.

Coal Cabinet with Rustic Ornamentation.—The coal cabinet illustrated by Figs. 1 to 4 can be made out of an old deal packing case 1 in, thick, and ornamented with various products of hedgerow and wood. It opens at the top, and the contained coal, which must be knobs, is taken from it by tongs. The back is 1ft. 9½ in, long by 11 in, wide, and the corners are sawn down and then rounded. The lower end is sawn out, as shown in Figs. 1 and 4, and a rebate, ½ in, deep and 1½ in, wide, is

Walnut shell might be used instead, but almonds are far stronger and more durable. To open the almond stones it will be necessary to soak them for several days in rainwater, when, if the contained kernels do not cause them to burst, they can be opened with a screwdriver. The corner ornamentations are formed of acorn cups, and the diamond in the centre is made up of similar pieces of wood as are used for the aides. The diamond measures 5\(\frac{1}{2}\) in by 3\(\frac{1}{2}\) in. A row of acorn cups is glued around its inner sides, and an oak gall forms its centre. The lid (Fig. 3) may be decorated according to the materials at hand. The one figured has in its corners four pieces of open ornamental brasswork, taken from a hanging hall lamp, and in the centre is a raised floral design, highly lacquered, from an old-fashioned cornice. A shallow rebate is cut all round the wood at the top to allow the lid to drop in rather below the level. The hinge is made of two 2-in. wire naila passed through the sides of the box into the lid, which is rounded off at the end where the nails enter to allow for free working up and down. A brass knob which was intended to hold a blind cord serves to raise the lid. The bottom of the cabinet is of 1-in. deal, and is simply nailed in its place with 2-in. wire nails, these being so placed that they are hidden by the ornamental work on the front and sides. Two coats

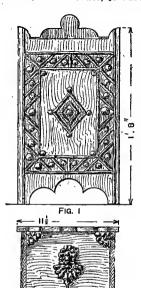
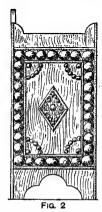
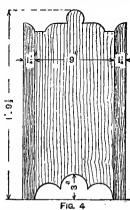


FIG. 3





Coal Cabinet with Rustic Ornamentation.

of Brunswick black are given to the inside of the cabinet, and the whole of the outside, after having been well sized, should receive two coats of walnut varnish stain.

Measuring Slaters' Work.—In the customary method of measuring slaters' work the length of the roof is taken from the elevation or the plan, and from the section for the width up the slope, multiplied together for area, and by 2 for the two sides. Whether the roof has gable ends or hipped ends, the total area is the same. The kind of slating must be described, the gauge or the lap, and the kind and the number of nails to each slate. Chimneys, skylights, dormers, etc., are either considered as equal-in saving slates and causing extra labour, and are therefore not accounted for; or by the better method the space the chimneys, etc., occupy is deducted from the slating, and an allowance of 6 in. all round is made in order to compensate for extra labour in cutting, and waste. Also at the edges of the curbs and eaves an allowance is made of 6 in. on each side for cutting to hips, valleys, and rakes. No allowance is made for cutting slates at the ridge or at a gable end. When the total is found it is divided by 100 in order to bring it to squares, and under this denomination is billed. Slating on conical roofs should be kept separate and fully described; the allowances would be the same as above.

British Aenhalt.—British aenhalt is an artificial

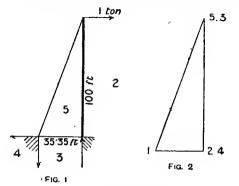
British Asphalt.—British asphalt is an artificial material used as a substitute for the natural asphalt found in other countries. This natural material consists of carbonate of lims and mineral bitumen, intimately combined by natural agency, the best being found at Val de Travers, Seyssel, Limmer, and at other places in France. Trinidad asphalt contains a large proportion of fine clay. British asphalts are made as described below. (1) A mixture of ground limestone, ground slate, and Trinidad bitumen, which if properly made is as dear as the real article without being so good; (2) a mixture of ground chalk, fireclay, and gas tar; (3) a mixture of pitch, gas tar, creosote, and sand, or sometimes ground ashes. The two latter mixtures either crack in winter or become soft in summer.

formed on the inside the whole length of the wood. The iront is 1 ft. 8 in. by 11½ in., and is similar to the back, but has no ornamental portion in the centre of the top. Its face ornamentation consists of two ½-in. rods of common hedge maple, which run the entire length ½ in. from the edge of each side. Other rods of hedge maple are fastened 1½ in. from these, and also 1 in. from the top edge, so as to form a double parallelogram, and inclined short lengths are fixed in, as shown in Fig. 1, cups of acorns being glued in the spaces. Near each corner of the inner parallelogram is an oak gall, filed flat on the side, by which it is glued to the wood. The centre is formed of maple arranged in the shape of a double diamond, measuring 6 in. by 5 in. outside. A natural cluster of acorn cups forms the centre of the diamonds, and each point is fitted with an oak gall. The maple used should have the roughest bark obtainable; there are plenty of pieces in the hedgerows with bark as rough as virgin cork. Each piece should be fastened on with \$\frac{1}{2}\text{in.}\$ in. the rads or gimp pins. The oak galls may be found on sapling oaks, and the acorn cups beneath maturer trees at any time in winter and spring. The sides are alike, \$\frac{1}{2}\text{ in.}\$ wide, and are sawn out in a similar manner to the front, but fit into the rebates made in the back and front, which protrude \$\frac{1}{2}\text{ in.}\$ to the fit. Strips of wood, \$\frac{1}{2}\text{ in.}\$ in, are fixed \$\frac{1}{2}\text{ in.}\$ from them, as shown in Fig. 2, all these projecting portions being rounded on the upper side. The ornamentation between the parallelograms is composed of almond stones, cut in two lengthwise. These are obtained from English trees, which often bear many fruits in a favourable season.

Uses of Powdered Charcoal.—Powdered wood charcoal is largely used in foundries, where the powder is dusted around the inside of the sand mould to produce very fine smooth castings. It is also used for lining crucibles, and in the manufacture of metallic oxides. Another use is found for it in making artists' crayons and in fine powder for black and white "stump" work. It is also largely used by manufacturers of common gunpowder. The price varies in part according to the kind of wood—beech and heavy woods are best for the reduction of the oxides, while alder and willow are preferred in gunpowder manufacture. The price will be higher in those districts where no charcoal-burning is done. Powdered charcoal is also much used as a disinfectant, and is one of the best deodorants known. It is also used in gardening for potted plants and for vines, and makes an excellent packing for bulbs.

Beer Finings.—Finings for beer are usually made by dissolving isinglass in beer and adding it to the remainder to be clarified, then agitating and allowing it to stand for some time. For a barrel of 36 gal., about ½ oz. to ½ oz. of isinglass dissolved in about 1 qt. of beer is used. The lisuglass forms a precipitate with some of the constituents of the beer, and carries down all the fine suspended matter; it does not remain in solution in the beer, and therefore does not affect its keeping qualities.

Anchors for Guy-ropes.—Assuming that the guy-ropes are made fast at the top of the mast, and that the effect of the wind will be equivalent to a



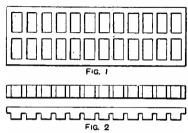
Anchors for Guy-ropes.

pressure at the top of 1 ton, the pull on the ropes will be found in the manner described below. Base formed by four points 50ft. apart, distance of each point from mast = $\sqrt{(25^2+25^2)} = 35.35 \text{ ft}$. Then, by frame diagram (Fig. 1) and stress diagram (Fig. 2); the upward pull on each concrete block will be, say, 2.8 tons, and the side pull 1 ton; the downward thrust of the mast will be, say, 2.8 tons + weight of mast; the stress in each rope say 3 tons. Each block should therefore weigh say 3 tons, or measure say 4 ft. cube.

Making Plaster Casts from Living Models.—
To take a mould, to be used for plaster casting, from a human foot, place the foot on some soft material, as a pillow or several thicknesses of cloth, in order that there may be as little undercutting as possible and to prevent the plaster, when it is poured over the foot, from running underneath. A little undercutting does not matter a great deal, as the flesh will give when the mould is removed. The foot must be thoroughly covered with sweet oil, not only to prevent the plaster from sticking, but to lay the hairs. If the oil has not enough body to do this, rub on a little vaseline. Now, in an eartherware basin, mix the plaster with warm water; this will have the double advantage of heing more comfortable for the person operated on and of making the plaster set quickly. Put a spoonful of plaster on the highest part of the foot, allowing it to run down the sides. Continue this, blowing the plaster into the spaces between the toes. If the plaster in the basin has by this time become too thick to pour, take it by the handful and spread it over the thin layer already applied. The mould (which should be from \(\frac{1}{2} \) in. thick) may be pulled off the foot as soon as the plaster begins to get warm in the process of setting, or even sooner if care is taken. One advantage of pulling off the mould as soon as possible, and before the plaster has become hard, is that any hairs which may not have been properly oiled down are not stuck to the plaster, and consequently the painful operation of pulling out the hairs,

as in a hard set mould, is avoided. Instead of settling the foot on a pillow or cloths, soft clay or modelling wax (procurable from any artists' colourman) may be used. This will take an impression of the under side of the foot, and virtually act as a mould, the mould being then in two pieces—the plaster top and the wax underside. These two pieces may then be tied together, and the cast taken in the usual way. Another way is merely to cover with plaster, to a thickness of about in., the part to be cast, as described above, and when set break it off in two or three pleces, which may be joined together afterwards. Still another way is to immerse the oiled foot in the basin of gauged plaster, and when all is covered, take out the foot and lay on the remaining plaster. The foot may be released by laying a waxed thread before the plaster is applied along the top and underneath to the heel, or right round the sides. The waxed thread will stick to the foot, and when the foot has been plunged in the plaster; and the plaster is nearly set, take up the ends of the thread and rip up the mould, thus dividing it into two or four pieces as the case demands. the case demands.

Model Bricks.—The mould for making bricks about lin. in length should be made preferably of brass or other metal, but it could be constructed in wood, and should he in four pieces—a smooth base-plate ll¼ in. by 3½ in. by ½ in.; a smooth mould ll¼ in. by 3½ in. by ½ in., in which are two rows of rectangular openings, each l¼ in. by ¼ in. (Fig. 1); a pressure plate with two rows of rectangles raised on the plate, each rectangle being l¼ in. by ½ in. by ½ in. by ½ in. Fig. 2 corresponding as shown in Fig. 2 corresponding rectangles raised on the place, each rectangle being 13 in by \$\dagger{\text{till}}\$ in by \$\dagger{\text{till}}\$ in, as shown in Fig. 2, corresponding with the holes; and a similar plate, but with the rectangles raised \$\dagger{\text{till}}\$ in. A press would be convenient, but pressure might be brought to bear with a heavy



Mould for Model Brick Machine.

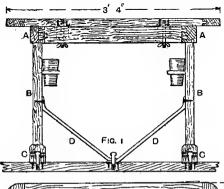
weight. The clay for these bricks should be kneaded with the very smallest possible quantity of water, should be nearly dry, and it is best to let it stand for a week or two, kneading it a little each day. When all is ready, place the mould on the flat base-plate and fill all the holes with the clay; place on it the pressure plate, and press this well home; remove the pressure plate and put in the fourth plate, turn over the mould, remove the base-plate, and then force down the mould by pressing it at each side. By this means the small bricks will be ejected from the mould. They should be dried slowly, first in a warm room, then in an oven, and burnt in a clear fire.

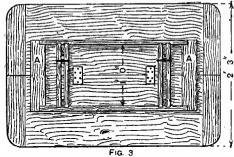
Taking Sample of Air.—The usual method of taking a sample of air is to use a wide-mouthed glass bottle having a tight-fitting stopper of glass or rubber. The capacity of the bottle should be about I gal. The simplest method is to clean the bottle thoroughly, fill it with clean water, and then empty out the water in the room from which the sample of air is to be taken. If such a procedure is impossible, the bottle, having been first cleaned and dried, may be filled by using a clean pair of bellows, care being taken that the air brought into the room in the bellows and in the bottle are first thoroughly expelled, and that a correct sample of the air in the room is taken.

Cooling Pond.—A cooling pond 40ft. square and 18indeep may be constructed in solid clay, and all that is necessary in that case will be a brick-paved bottom and 9-in. walls, surmounted by a blue brick coping; or, if preferred, the bottom may be formed of 6in. of concrete and the walls also made of concrete. If the ground is permeable, then the same construction may be followed, and the pond lined with 1 in. of natural asphalt, the outside and underneath the floor being formed of 10 in. or 12 in. of well-puddled clay. Another method that may be suggested (provided the ground is formed of solid though permeable materials, such as gravel or sand) would be to form the pond of concrete 4 in. or 5 in. thick, lined with 1 in. of asphalt, and the bottom covered as a protection with brick flat paving, and the sides formed of a 4½-in. wall in front of the asphalt. Cooling Pond .- A cooling pond 40ft. square and 18in. asphalt.

Jointing Acetylene Pipes.—At one time the ordinary lead mixture was said to be unsuited for jointing irou pipes for conveying acetylene, and that joints made with it would soon leak. The gas was supposed to have a destructive effect on the jointing material, chiefly by softening or liquefying the oil used, and a German chemist stated that a remedy for this was to use castor oil instead of linseed. However, later results showed that the trouble was largely imaginary, and was due ohiefly to the impurities that appeared in the acetylene of that time. The ordinary red and white-lead mixture is now used by almost everyone, and is quite satisfactory. The material should be used sparingly, so that the least possible quantity is carried in front of the male end of the pipe as it is screwed in.

Yacht's Table.—The table 'shown in elevation by Figs. 1 and 2 will be suitable for small yachts where space is limited, and it could be made of timber to match the interior of the cabin, but teak is generally used in yacht work. The size is, of course, determined by the space available. In Fig. 2 the dotted lines show the table extended, the two leaves or top being hinged, the top leaf opening to the left, and the bottom leaf being drawn to the right till the hinge is at the centre of the body or frame. The body is made like a shallow box, the end pieces A (Figs. 1, 2, and 3), into which the bottom and aides are dovetailed, being 2½ in. by 2½ in. The groove at

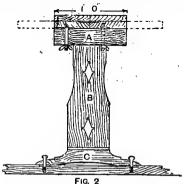




each end for the two ½in. sliding bolts is formed by checking two ½in. pieces into the sides the depth of the inside, and the ½in. bottom is nailed to these pieces, which divide the body into three compartments, for cutlery, etc. Pulling the top to the right while the table is folded forms a drawer. The depth inside is 2 in. The two sliding bolts are threaded at each end, the top ends fitting in cast sockets let into the under side of the leaf, while a fly-nut and washer at the lower end hold the top in position. The legs B (Figs. 1 and 2) are of 1½in. stuff, and the tops, 5 in. wide, are mortised into the end pieces, and the bottoms, 7 in. wide, into feet C. These are 18in. long by 3in. by 2½ in., and are held down by thumbscrews fitting into sockets let into the cabin floor. The stays D (Fig. 1) are of ½in. galvanised iron, flattened and swelled at the ends to take screws, with a thumbscrew at the feet. A glass or hottle raok can be fixed inside the legs if required; see Fig. 1. The table looks well if varnished in the natural wood.

Preservation of Boots and Shoes.—Boots often wear badly and look unsightly owing to neglect. Boot trees are essential if boots are to keep shapely, and they are useful for holding boots while these are being washed, polished, etc. Blacking leather boots are either calf or horse-akin, the latter being sometimes

called crup, quagga, or even porpoise hide. Calf is best for summer wear, being more porous than horse-kin, and it is more economical for people with warm or perspiring feet, as the dense horse-skin retains the perspiration, and this combined with the heat of the perspiration, and this combined with the heat of the poot, impoverishes the leather and causes it first to become hard, then to crack. It is desirable to have two pairs of boots in use, wearing one pair for about three days, the other pair being on trees meanwhile. A thin coat of dubbin applied when the boots are first put on the trees will have time to penetrate, and the boots will be comparatively soft when taken in their turn to be worn. This treatment, however, is necessary only in extreme cases, wet boots should not be stood in the fireplace or thrown, soles down, anywhere out of the way. The former does harm to the boots and the latter to the wearer. Boots must not be placed too near a fire. To dry them gradually, set them about 2 ft. away, with the soles toward the fire. If trees are available, put them in when the boots are about half dry; but do not tree boots that are sodden if it is desired to wear them next day. When wet boots or shoes are thoughtlessly thrown on the floor, the wet cannot get away, and the soles, being the hardest part, retain the damp, which strikes through the middle to the inner sole. When one has been out in ever so small a shower, it is a good plan to lay the boots on their sides, in order that air currents may get to the

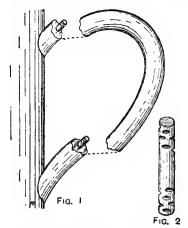


Yacht's Table.

wettest parts. Too much blacking on boots tends to rot them; but used discreetly blacking does not injure. Bottle blacking is recommended, but if this is too expensive, work up cake or tin blacking to the consistency of cream with equal parts of water and vinegar or sour beer. When using, well stir it to avoid unsightly streaks. Procure a piece of board about 12 in. long by 6 in. wide, put a little blacking on the centre, and ruh the blacking brush up and down, so as to get the blacking all over the brush. Do not rub one end of the brush upon the board in a circular direction, as is usually done, but use it in the same manner as a polishing brush is used and the brush will then wear even. If a brush is cloged with blacking, leave it in water over night and well rinse in the morning. By so doing it will be rendered almost as nice to use as a new one. Boots caked with blacking should be put on trees and washed with soap and warm water until all the blacking is removed. Stand them in the sun, or in a warm place indoors, and when about half dry rub well with dubbin, Russian tallow, neatsfoot oil, or mutton fat. If the latter is used, a sheep's tail is heat. All blacking leather boots should be washed and olled occasionally as the leather requires nourishment to prevent it cracking. New patent leather boots should not fit too easy because if the leather creases freely the enamel is sure to crack, and the leather will then sometimes break. Get them as close-fitting as they can with comfort be worn; but do not depend too much upon their stretching, for patent leather will, as a rule, stretch but little. If patents are only worn occasionally, trees should certainly be provided for a thin coat of vaseline or dubbin rubbed over them to prevent treaking when the boots are taken for wear again. Alwaya keep patents in a warm room if possible, as this tends to prevent cracking. When new, clean them with cream sold for that purpose; when about half worn out, it is better to varnish them, for which purpose the trees will again

to remove the varnish use spirit of wine. When buying boot varnish look at the directions on the label of the bottle; if it is stated that spirit will have to be used to remove the varnish, do not buy it, as it is injurious. Tan boots are very comfortable; nearly all the natural oil is removed in the process of curing and colouring the leather which is left very porous, and, as a rule, soft. Lacing boots are best in tan, because the leather, being rather dry, is unsuitable for buttoning. A button-hols will frequently hreak the first time if the boot fits tightly over the instep. For cleaning brown boots some prefer paste, but cream is better hecause it is much thinner and does not cake or dry white along the stitches; it will also keep longer, and the same kind will do for both tan boots and patents. Tan boots require well looking after when they are desired to retain a good colour and shape. When dirty, they must be washed with soft soap and warm water. If this does not remove all stains well rub the stained part with a cut lemon. This is good for removing grease stains. Another way is to rub the boots with oxalic acid dissolved in water, applying it chiefly to the part stained, and wetting the hoot all over, so that it will not dry patchy; but the use of acid should be avoided when possible.

Repairing Handles of China Jugs.—If the jugs are valuable and are used only as ornaments, cement may prove satisfactory, as the disfiguring effect of rivets is then avoided, but if the jugs have to be handled (and the



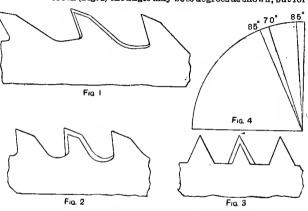
Repairing Handles of China Jugs.

breakages allow such a plan to be adopted), fine wire rivets should be employed to strengthen the joints. When a thick handle is broken, china repairers often employ wire (not more than i in long) to strengthen the joint without being visible. As shown in Fig. 1, a hole, somewhat larger in diameter than the wire, is carefully drilled in each piece of the handle, and the wire, after having its ends roughly notched (as shown in Fig. 2) by a file, is fixed in position with a very little plaster-of-Paris, which is placed in the holes before the wire; if too much were used, some of the plaster would be forced out of the holes by the wire, and would prevent a close join being made. The faces of the broken parts are also thinly smeared with a suitable cement when the pieces are ready for joining.

Cold Storage Room.—A small cold store should be built in the shade; and timber probably is the most suitable material. The best method is to fix uprights into the ground, to cover the inside and outside with in boards, and to fill the spaces with slag wool, or other sterilised material; moss or sawdust will not be satisfactory for a meat store. The outside should be covered with roofing felt, and whitewashed to throw off the heat. The floor should be of wood, also double in thickness. The whole place should be washed out frequently with disinfectant liquid. To keep the place cool, that is at a temperature below about 40° F., it may be sufficient to keep in the room one or two blocks of ice, so arranged that, as they melt, the water is quickly drained away to the outside. A chemical mixture made as follows will bring down the atmosphere in the cold store below freezing point: The mixture consists of coarsely powdered Glauber's salt (sulphate of soda) on which is poured about two-thirds its weight of muriatic acid; this, however, has a somewhat disagreeable odour, and the vessel in which

It is placed should be kept closely covered. Another mixture consists of 11b. of muriate of ammonia, or salammoniac, intimately mixed with 21b. of powdered saltpetre; this is to be mixed with an equal bulk of best scotch soda on which is poured about half the bulk of cold water—thatis, if 1qt. of salammoniac and saltpetre is mixed with 1qt. of Scotch soda, then 1qt. of water will be required. Or nitrate of ammonia, which is free from any corrosive action or unpleasant odour, may be used; this, if simply dissolved in rather less than its own weight of water, reduces the temperature to about 25° F. below freezing. This salt is somewhat expensive, but may be recovered again and used any number of times by simply holling away the water in which it is dissolved over a gentle fire until it crystallises on cooling.

Teeth of Circular Saw.—Fig. 1 shows a circular saw ripping tooth, and about 5 degrees face bevel and 10 degrees top bevel answer well. Figs. 2 and 3 show cross-cut teeth. For cutting both hard and soft wood, Fig. 2 will be suitable. In the smaller saws, especially for cutting soft wood, Fig. 3 answers well if given a long bevel as shown. The face and top bevels in Fig. 2 should be much more acute than those shown in Fig. 1, as the work of this tooth is to cut across the fibres of the timber. As the fibres of soft wood are less compact than in hard wood, the bevels should be more acute for cross-cutting soft wood than for hard wood. Regulate the hevels according to the work. Suitable leads for the teeth in Figs. 1 and 2 are shown in Fig. 4. For ripping hard pitchpine the angle of 70 degrees will be suitable, and for mellow timber, 65 degrees. For the cross-cut tooth (Fig. 2) the angle may be 85 degrees as shown, but for



Teeth of Circular Saw.

cross-cutting dry hard wood the tooth should be upright, or to an angle of 90 degrees. The number of teeth in the rip-saw should be 50 to 56, and about one-third more in the cross-cut saw.

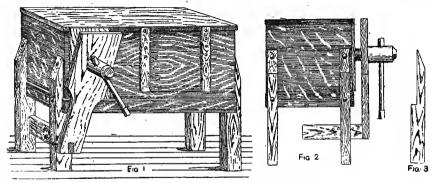
Thickening Raw Linseed Oil.—Whatever process is tried to thicken raw linseed oil, the resultant product will be found to be but little different from the raw oil. Raw oil boiled over a naked fire to 250° or 300° C. for several hours with 5 to 10 per cent. of acetate of lead will give a product possessing great elasticity, and if necessary it may be made to approach rubber in consistency by varying the amount of drier and duration of the process of boiling. The method adopted is to place the oil in a large pan with a capacity of double the quantity of oil to be treated; this is necessary owing to the violent ebullition of the oil whilst the lead is added. The oil is heated to 75° C., and the lead added steadily whilst continually stirring. The temperature is then raised to 100° C. for a little time; this drives off all the water, etc., in its composition, after which the temperature may be raised to 250° C. or 300° C. to thicken. The consistency of the oil may be determined by taking small samples out of the pan from time to time and placing in water to cool. Oil thickened by this process may be used with advantage for varnishes and solid oils, also for the manufacture of linoleum; for the latter purpose it is mixed with fine cork sawdust, resin, etc.. It is also used for many other purposes in the industrial arts.

Protecting Mirror Back from Damp.—When an overmantel containing a mirror is placed on a wall of a damp house, cover the back of the mirror with fiannel, and over the fiannel place a sheet of Willesden 2- or 4-ply damp-proof paper.

Peroxide of Lead.—To prepare peroxide of lead, proceed thus. Take some red-lead (red oxide of lead) in dry powder, and treat it with dilute nitric acid (acid 1 part, water 3 parts); stir well, and after standing for a few hours, decant off the acid, wash several times with clean hot water, stirring up the deposit each time, and allowing it to subside before pouring off the water. Drain off as much water as possible, then place in a shallow dish, and dry in a warm oven. The result will be a brown powder of peroxide of lead.

Converting Sea Chest into Carpenter's Bench.—
Fig. 1 is a general view of a carpenter's bench, and
Fig. 2 a vlew of one end. A sea chest from which
this bench could be made is 3ft. in length, 1ft. 6in.
in depth, and 1ft. 8 in. in width. The working surface is
thus rather limited, but the general amateur does not as
a rule tackle big jobs, and, moreover, has not too much
room. As 2ft. 6in. is about the proper height for the
top of a bench, the chest is fitted with legs (Fig. 3), which
raise the bottom 1 ft. above the floor. They are formed
of scantling 3in. by 2in., and are 2ft. long. The width
is halved from the middle to one end to provide a
shoulder on which the chest rests. The bevel starts
about 5in. from the top end. The legs are fastened to the
chest sides 1in. from the front and back by bolts 2in.
and 3in. long, and the plinth is cut to allow the legs to
lie close to the sides. Or by a little shaping of the legs
this could be avoided. The leg occupying the left front
corner has a rectangular aperture cut in it 1 in. wide
and 3in. long to take the rail, which is mortised to the
lower end of the vice cheek. This rail has a number of
holes bored in it for taking a wood or metal pin which

means of a weight or several sheets of newspaper. After six weeks remove the paper, and carefully remove a few of the leaves and place them in a basin of warm water. This is not a particularly pleasant operation as the leaves are now decomposed, and although the hand is the best for the purpose, a large wooden spoon may be used instead. Take a leaf between the thumb and finger, under water, and ascertain by gentle rubbing and pressing whether the fleshy part of the leaf is sufficiently loose to come away from the fibres. With the tougher specimens a email brush may be used, the leaf being laid on a flat surface such as the palm of the hand or a plate. After this first washing, perhaps a few leaves will be quite clear. Those that are not must be immersed for perhaps two or three weeks more. Some leaves such as those of the birch, chestnut, walnut, and oak, contain so much tannin that they must be treated in a vessel by themselves, otherwise the tannin would act as a preservative to the other leaves, and it would he months before they would show any sign of decomposition. After about nine weeks the poplar leaves will be found perfectly clean, but the leaves of the sycamore, elm, pear, and maple will require moving to another vessel. Magnolia leaves make very good specimens, but require three or four months' soaking before the feshy outer coat can be removed. The few leaves that are quite clear may now be carefully dried between the broken in the actor removing. Should the stem only be missing, do not discard the leaf, as an artificial stem can be made and fixed to it. The dry leaves made of



Converting Sea Chest into Carpenter's Bench.

regulates the distance separating the two vice faces. The vice cheek is 2ft. 3 in. by 8 in. by 1 in., and is shaped as shown in Fig. 1, the hole for the vice screw being 7 in. from the top end. The screw, of course, pierces the front of the chest, to the inner surface of which a nut is screwed. As the lid and plinth project in., a piece of lin. stuff, 8 in. wide, and long enough to reach from the top surface of the chest to the plinth, is screwed to the front to suit the vice jaw, sufficient being cut away to baard or similar article while one end is held in the vice, two ralls, 1 in. by 1 in. in section, are drilled to take a wooden peg. and are screwed to the bench front as illustrated in Fig. 1.

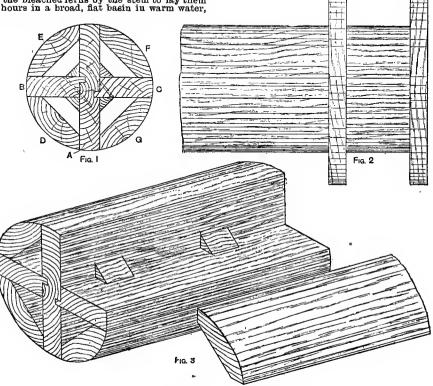
Preparing Skeleton Leaves.—Skeletonising leaves and seed-vessels is delicate work, the materials being so fragile that the least slip may destroy them. Suitable leaves when held up to the light present a fine network of fibres enclosed in a tough outer skin on each side. Skeletonising removes every part of this outer covering. The greenest and best shaped leaves are not always the best; although insects may not have pierced them, yet the fibres have not become sufficiently woody to sustain the necessary pressure and handling. On the other hand, leaves must not he left until they are too old and too tough for maceration. Leaves from the following are suitable. Horse chestnut, elm, European sycamore and maples, linden, magnolia, laurustinus, hazel (to be gathered early), willow, pear, quince, rose, apricot, medlar, ash, beech, rhoddendon, camellia japonica, box, broom, barberry, holly, ivy, begonia, wistaria, and briers. The following calyxes, modified leaves, and seed-vessels, also are suitable. The levant heads of the poppy, thorn apple, mallows, henbane, nicandra, wild sage calyx, Canterbury bells, hydraugea, and fig wort. Place the leaves in a large earthen pan and cover them with soft water, and set in a warm, sunny place in the open air, keeping the leaves completely immersed by

white blotting-paper, which keeps them flat and completes the drying. To remove the outer skin of such leaves as the camellia japonica, Cape jessamine, laurustinus, etc., dissolve 3 oz., of washing soda in 2pt. of soft water, adding 14 oz. of slacked lime. Boil for about ten minutes, let it stand and settle; then pour off the clear liquor and place on the fire and boil. When boiling, put in the leaves and boil briskly for about an hour, adding hot water occasionally to supply the waste by evaporation. Take out a leaf and try it, as before described, and if the epidermis comes off cleanly, remove from the fire. For bleaching the specimens, a solution of chloride of soda or chloride of lime is used with very great care. The chloride of lime solution is prepared by diesolving ½ lb. of strong chloride of lime in 3 pt. of soft cold water and allowing to settle, and then pouring the clear liquid into a bottle. Place the leaves to be whitened in a widemouth glass jar and cover them with clear soft water, adding the bleaching solution in the proportion of two tablespoonsfuls to 1 pt. of water. Cover the jar tightly and set it in a warm place for from six to twelve hours. This strength of solution suits delicate leaves and ferns, but for coarse stems and eeed vessels it may be doubled. When arranging leaves for bleaching, put them in the jar, stems downward, as the bleaching commences at the bottom. The stems and midrits will thus have a little more time to whiten. When bleached, remove the specimens and place in a basin of clear warm water. Change the water several times to remove the chloride, dry the leaves in the folds of a towel, and afterwards place them in the blotting-book, where they may remain. A quicker method of bleaching is as follows. Mix about 1 cr. of chloride of lime with 1 pt. of water, adding sufficient acetic acid to liberate the chlorine: steep the leaves in this till they are whitened, taking care not to let them stay in long enough to become brittle. Then should be gathered when the seeds are on t

Curl the large leaves round the sides of the jar, and place the small ones in the centre. Add warm water and bleaching solution, cover tightly, and put in a warm place for a day; then pour off the liquid and replace with fresh of the same strength. Let them remain in the second water for forty-eight hours, and chauge again. Generally, in three or four days the ferns hegin to whiten at the edges. Remove those that are finished and leave the others till they are thoroughly bleached, which may be for three or four weeks, during which time the solution should be constantly changed. After this, if any are found unchanged, they are unsuitable. If the tip of a large spray whitens quickly while the stem and upper end remain spotted, it is best to cut the white part clean off and immerse the spotted part till completed. Before mounting, the pieces can be joined with gum arshic. Very delicate handling is necessary when taking out the bleached ferns by the stem to lay them for several hours in a broad, flat basin in warm water,

with a small seed-vessel or white wax and, after covering about two-thirds of the wire with leaves, gum the end and fix through the cushion into the woodwork of the base. In conclusion, let everything be arranged as naturally as possible, avoiding large burrs at the top.

Hollow Wooden Roller for Stage Curtain.—The illustrations show a hollow wooden roller for the bottom of a stage curtain. The roller should be constructed of wood about lin. thick. If possible the timber should be obtained the full length required, so that it will not be necessary to join the pieces in their length, as this would tend to produce sagging. If it is not practicable to obtain timber the full length, the joints of two adjacent pieces should not be nearer together than



Hollow Wooden Roller for Stage Curtain,

which will require to be changed several times. In drying, place a sheet of blotting-paper under the fern and lift it on to a soft towel. Gently uncurl any folded leaves with a pin and allow to assume the natural shape. Then lay the sheet between blotting-paper and press it in a book. If it is found that the fern or part of it adheres to the paper, press the under-side with the thumh nail. In mounting skeletonised leaves, procure a glass shade to suit the size of a houquet or group it is supposed is to be made, and cover the hase with a cushiou of dark blue or black velvet stuffed with layers of cotton-wool and highest in the centre. Neatly glue the velvet round the edge, at the same time make sure that the shade stands firmly in the groove. With some white gum arabic dissolved in a very little water, supply stems to those which were lost in the macerating process, by using the old stems bleached purposely for use, or wire covered with white paper, or, better still, white crotchet cotton and coarse sewing thread steeped in gum arabic and allowed to dry stiff. Gum the underside of the leaf and let the new stem extend for some distance along the midrih. This cannot be detected easily if done neatly and if the right-sized thread is used. Leave the stems ahout 3 in. long and cut to suit when mounting. For a low, flat shade, make a hole in the centre of the cushion and start with the largest leaves as a foundation, building up the group with the lighter finer specimens. For a tall shade, use a foundation of stout silk-covered bonnet-wire. Top the wire

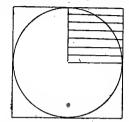
2ft. After the several pieces are squared up as true as possible, the main piece A (Fig. 1) should be ploughed as shown. The pieces B and C should next be prepared with tongues so as to fit into the plough grooves made in the piece A. These parts should be glued together and secured by skew-nalling, and additionally strengthened with a few small angle blocks, as at Figs. 1 and 3. The pieces D. E, F, and G which form the main surface of the roller will require their edges bevelling at an angle of 45°, and must be made to fit with good joints to each of the parts A, B, and C. These joints should be glued and runbed and further secured by skew-nailing. When the glue has thoroughly set, the roller should be planed to shape. No difficulty will be found in making the flanges shown in Fig. 2 if required for the reception of the cord.

Polishing Celluloid.—Powdered pumicestone applied on felt with plenty of water is suitable for smoothing celluloid after it has been emery-papered, but for polishing, whiting and water or putty powder and water should be used, finishing with a little dry whiting and then with a clean velvet pad.

Carbolic Tooth Powder.—For tooth powders is used either a soft variety of earth known as silica, or precipitated chalk. The proportions are about 8lb. of silics or chalk, 1lb. of venetian red, and 1 dr. to 2 dr. of pure carbolic acid. To get a uniform product, a large quantity must be mixed at one time.

Lightning Conductors.—Lightning conductors when properly made and fixed protect the space below them which would be contained in a cone, of which the upper terminal forms the apex and the base on the ground has a radius equal to the height. The upper end should terminate with a charp point, and Ift. below the point there should be attached by screws and solder a copper ring bearing three or four copper needles 6 in. long, tapering from \$\frac{1}{2}\$ in. to a fine point. For a factory chimney, a coronal or copper band with stout copper points at intervals of 3 ft. or 4 ft round the circumference will be most cuitable. All points should be platinised, gilded, or nickel-plated to prevent corrosion. The upper terminal should be eccurely fixed in place, and connected to the copper tape by Cutting's registered coupling or other safe connection. The main conductor should be of solid rolled copper tape proportioned in sectional area in square inches = 01 \(\int h \) ft. about. It should touch sectional area to the height of the building, say sectional area in square inches = $01\sqrt{hft}$, about. It should touch the building all the way down without insulation, be held by clips at every 4ft. to 6ft, and be electrically connected to all masses of metal in its neighbourhood. The lower end should be carried down 2ft. under ground and 10ft. away from the building, riveted and soldered to a sheet of copper 3 sq. ft. area for each 100ft. in height, γ in. to $\frac{1}{2}$ in. thick, and embedded in moist earth or coke breeze.

Notes on the Circle.—In solving problems on the circle numbers such as 3.1416, 7854, 07958, etc. etc., constantly are employed. Of the three numbers, 3.1416, 7854, and 0.7958, it is really only necessary to remember the first, since the others can always be derived from it. This one number, however, is worth committing to memory; a good way of doing this is to write it a



Determining Area of Circle.

number of times during any spare moments. The second number '7854 is exactly a quarter of the first 31416, and is quickly obtained at any moment by writing down the latter and dividing by 4. The simple working of a problem without any explanation, and the using of formulæ which the student may not understand, does not help, but rather perplexes; but if the operations be simply and concisely explained, the tyro can then comprehend them, and fix the principles indelibly in his memory. The circle contains the greatest area of any plane figure of equal perimeter, and has more peculiar properties than any other figure. The circumferences of circles are as their diameters or radii. The proportion between the diameter and circumference of a circle is as 7:22, or as 113:355, or as 1:3:1416. In other words, the circumference is about 3; times the diameter. This proportion is obtained as follows. The circumference of a circle has never yet been exactly expressed in terms of the diameter, though very near approximations have been made. The perimeter of the inscribed or circumscribed polygon may continue to approach nearest to the circumference of the circle by increasing the number of sides; however, it will never become equal to it. If the diameter of the circle be 1, the perimeter of the inscribed hexagon will be 3, that of the circumscribed hexagon will be 3, that of the circumscribed and a dodecagon inscribed, its perimeter will be 3'10828, and that of the circumscribed one of an equal number of sides is but 3'1427136. Thus as the number of sides is increased, the difference between the perimeters is seen to lessen, and when these bisections are further continued, the inscribed polygon of 96 sides is 3'141024, and that of a circumscribed polygon of 96 sides is 3'141024, and that of a circumscribed polygon is found to be 3'14159265, and the circumscribing one 3'141926937, and as the circumference of the circle is less than one, and greater than the other, 3'14159265599 increased. Hence the rule is deduced: As 7:22: the

As 7:22::70:223, the circumference, or, as the circumference of a circle is, say, 3} times its diameter, therefore

ference of a circle is, say, 3\} times its diameter, therefore $70 \times 3\} = 220$. If the diameter or the circumference of a circle be given, the area may be found as follows:—

I. Multiply half the diameter by half the circumference, and the product will be the area.

II. Multiply the square of the diameter by '7854.

III. Multiply the square of the circumference by '07958, and the result in each case will be the area.

I. Suppose the diameter of a circle is 1; what is the

It has been shown that when the diameter is 1, the circumference is 3'1416. Therefore, diameter $1 \div 2 = 5$.

Circumference 3 1416
$$-2 = 1.5708$$

1.5708 \times 5 $= .7854 = area$

This is how '7854 is obtained, and remember, it is the area of a circle whose diameter is I. It may be conceived that the circle is made up of an infinite number of triangles whose bases form the circumference, and whose vertices meet in the centre of the circle, with the radius as common perpendicular; hence the I. rule is deduced. 41 I. Euclid.

II. Suppose the circumference of a circle is I, what is the area?

Circumference
$$1 \div 2 = 5$$

Diameter $31832 \div 2 = 15916$
 $15916 \times 5 = 07958$.

This is how 07958 is obtained, and remember, it is the area of a circle whose circumference is 1. The circumferences of circles are as their diameters or radii, hence their areas are in the duplicate ratio, or as the squares of their diameters. (2 XII. Euclid.) To show the application of those decimal numbers in finding the diameter and area of a circle, two examples are given below:—Suppose the area of a circle is 1 2732, what is the diameter?

As
7854
 : 12732 :: 12 : 12 : 12 : 12 : 12 : 12 : 12 : 12 : 12 : 12732 : $^$

The circumference of a circle is 12 566. What is the

As
$$1^2: 12.566^2: .07958: x$$

... $12.566^2 \times .07958 = 12.566 = required area.$

These two examples show some curious properties of the circle. In the first, the area and diameter are expressed by the same number. In the second, the same number expresses the area and circumference. When any number is in such frequent use as the one under discussion, it becomes necessary to have some quick way of expressing it, and therefore the symbol π is universally adopted to represent 31416, that is to eay, whenever π occurs in any expression, it means 31416. This fact constitutes the key to many scientific formulæ. The area of any circle may be found by squaring the radius and multiplying by 31416, expressed.

area = radius
$$^2\pi$$
, $a = r^2\pi$.

or $a=r\pi$. In the accompanying diagram the small square is the square on the radius of the circle, while the large square is the square on the diameter. The latter square is obviously four times the former, and since we multiply the small square by π or 3'1416, we must multiply the large square by a quarter of π , or '7854, expressed:

area = diameter $\frac{\pi}{4}$, $a=d^2\frac{\pi}{4}$

When the area is to be found from the radius, we can either square it direct and multiply by π , or double it, to obtain the diameter, which is then squared and multiplied by 7854; the method used will depend on the particular figures given and good judgment. The number 07958 can always be obtained by dividing 25 by π ; but it is seldom wanted, because when the circumference is given, to find the area it is only necessary to square it and divide by 4π , or four times 3 1416, expressed:

$$area = \frac{circumference^2}{4\pi}$$

$$a = \frac{c^2}{4\pi}.$$

Strictly speaking, π is slightly under 31416; it is 3141592...., as stated above. But when only four decimal figures are used, 31416 is nearer the truth than 31415; though when five decimals are used, 314159 is correct.

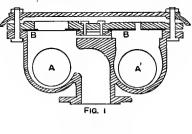
Screwing in Dresser Hooks.—Screwing in dresser hooks with pincers and pliers is a very unsatisfactory job, usually resulting in many broken hooks. A thick saw kerf about 1 in. deep in the end of a short piece of 1 in. by 1½-11. stuff simplifies the matter considerably, and, if there are many to do, it will pay to make a hardwood screwdriver of the pattern suggested.

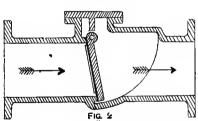
Straightening Watch Balance Pivot.—To straighten the balance pivot of a Geneva lever watch, hold the balance up to the light and turn it round to eee the exact direction of the bend. Then straighten it with a pair of brass-nosed pliers, When as near straight as can be seen by holding it up, place the balance in a pair of brass callipers and see whether lt runs quite true. Finally, prize the balance again, as the bending is sure to have disturbed it a little.

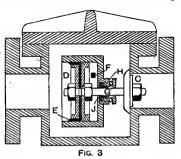
Air Valves on Water Mains.—Below is explained, with the help of illustrations, the construction and use of air valves and retardation pipes as used on water mains. Fig. 1 shows a section of a double air-valve, one side of which, acting under pressure, permits the escape of the air that occasionally accumulates at the tops of the bends where mains pass over hills; the other side of the valve lets out the air when the main is charged. The two ebonte balls AA (Fig. 1) press against the rubber seats BB when the mains are fully charged with water, the action being as described below. When the water is turned on, it rushes through the pipe and air is driven out through the holes on the top; as soon as the water reaches the balls, they float up and press against the rubber seats. Any air that accumulates in the main will rise to the highest point and displace the water; the ball A' will float on the water, and as the air increases the water will be pushed out of the ball chamber,

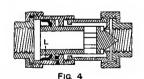
pressure piston. The piston is packed with a cup leather E, the chamber behind the piston having a hole F open to the atmosphere. In the larger valve the piston works in the cylinder G, the rod working through a gland H; this gland is made water-tight with an hydraulic leather J. In the smaller type, the piston is hollow, working on a sleeve, and made water-tight by working through a cup leather L; this is made clear in Fig. 4.

Thatched Roofs.—Thatching is the most picturesque form of roof covering that can be adopted for country houses not exceeding two storeys in height, and is warmer in winter and cooler in summer than elates or tiles. But this is all that can be said in praise of thatch, which (even if permitted by the local bye-laws) is most insanitary. The reed soon begins to rot, and the thatch must be often renewed, and anyone who has not seen a roof stripped for re-thatching would be surprised at the quantity of rotten straw that a roof will yield, to say nothing of vermin, etc. Almost any intelligent farm labourer can do a bit of thatching after a fashion; but the number of good thatchers (owing to the decadence of the art) is yearly growing less. A badly thatched roof is a source of constant trouble and expense, for unless the reed is properly laid, a high wind might strip a roof in a few hours, or heavy rain might soak through and damage









Air Valves on Water Mains,

the ball dropping with the water until the seal is broken and the air rushes out. As the air decreases, the ball rises with the water, presses against the rubber seating, and the seal is again complete. The ball A will not fall, but remain closed, except when the main is empty; this is because the large pipe is in communication with the ball chamber; the chamber of the other communicating with the main by a small hole. Fig. 2 shows a backpressure valve. These valves are used on long pumping mains that run through undulating ground, and are placed at comparatively low levels. In the event of a pipe bursting below ground, the valve retains the water in the mains. Figs. 3 and 4 show sections of Layton's patent pressure-reducing valve; Fig. 3 shows a valve for mains ranging from 2in. to 12in. in diameter, and Fig. 4 shows a valve for pipes from ½ in. to 1½ in. in diameter. The object of these valves is to reduce the pressure in descending mains without having recourse to an expensive system of cisterns, an arrangement that is in many cases quite impracticable. Pressure that is higher than is necessary for the effective distribution of water is a decided disadvantage; such high pressure destroys the fittings, and so causes waste of water. This destructively high pressure is, however, effectually checked by using the valve referred to, so that the fittings last longer and the waste of water Is prevented. The valve is simple in construction and automatic in action, and can be so designed as to reduce the pressure one-fourth, one-third, or one-half, as may be desired. A pressure gauge can be attached to the main on each side of the valve is that of a high-pressure acts on a spiston of larger area that the four-pressure acts on a spiston of larger area that is proportioned to the reduction required. In the drawing, C is the high-pressure valve and D the low-

walls and rafters, and cause the thatch to rot very quickly. Unless, also, a roof is skilfully thatched, one of the principal recommendations of a thatched roof (its picturesqueness) is absent. If any other form of roof covering is available at a reasonable cost, thatching (having regard to all the contingencies) can scarcely be said to be the cheapest form of roofing. Thatching could be laid over a boarded and felted roof, and as far as the boarding is concerned some advantage might be gained, but there does not appear to be any advantage in adding felt. If thatch is put over corrugated iron, the iron would perhaps afford somewhat more protection in case of a small fire occurring; but galvanised iron is bad for an interior lining, as the iron does not absorb moisture, and is spt to drip when warm moist weather follows a cold spell. Even in country districts thatches are being superseded by slates, tiles, and, in some cases, shingles.

Cheap Glossy Red Paint.—The basis of cheap glossy paints is either resin varnish or cheap oak varnishes. To prepare a resin varnish that would answer the purpose, place 7 lb. of pale resin in a suitable vessel over the fire until melted, then take the vessel well away from any light or fire and add 1 qt. of benzine, 1 pt. of boiled oil, and 2 pt. of cheap oak varnish, stirring thoroughly until all the ingredients are blended together. If on cooling the preparation should thicken, add more benzine. To prepare a signal red or vermitionette or red oxide colour, obtain these pigments in the form of paste paints and thin them down with a small quantity of benzine, and finally str into the varnish described above. These paints, if applied warm, dry with a hard enamel-like surface in about four hours; if applied in the usual manner, they take about six hours to dry.

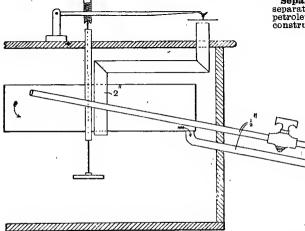
Polishing Pearl Shells.—The method of polishing pearlshell work is as follows. If the shells are in a rough state, they are freed from the rough skin by meane of hydrochloric acid. As this readily dissolves the shells, care must be exercised lest it eats holes through them. Deep scratches can be removed and a level surface gained by means of a scraper, file, emery cloth, or emery powder. If largs quantities of shells are to be polished, a lathe or spindle carrying bobs of cloth will be required; these carry the shells through various stages, grinding the surface level with emery, smoothing with rottenstone or charcoal, and finally polishing on buff leather with whiting or chalk. The various substances are moistened or made into a paste with vinegar or dilute sulphuric acid; hot water or oil of any kind must not be used. If only a few shells are to be polished and no mechanical appliance is at hand, cloth may be folded into a firm pad, or may be tightly stretched over blocks of wood or cork for each grade of polishing powder, the final lustre being brought up by precipitated chalk and the palm of the hand.

Heating Incubator with Hot Water.—It is practicable to supply an incubator from a separate hot-water apparatus, but the regulator must be worked on a ventilating shaft. The mechanism is precisely the same as that used to control the heat obtained

those of the creeper named above, and sometimes, in course of a long period, loosen the stones. Ivy is also a strong grower, and when it reaches a roof the plant is apt to push its young shoots under the slates or tiles and throw them off. On the whole, Ampelopsis Veitchit is to be recommended as the best all-round wall screen, having the best appearance at all seasons, doing the least damage, and requiring the least attention.

Heads of Ventriloquial Dol's.—The heads of small "knee" figures (as they are called) are hest carved out of wood; for larger figures the heads are masks made by building up brown paper with paste on the inside of a plaster-of-Parie mould. A sheet of thin ciled paper is first pressed into the mould to keep the mask from sticking to the mould. The hack of the mask is left open and the wig supported by a strong wire frame. The jaw is hinged at the back. A plece of elastic keeps it pulled upwards, and a piece of wood fastened to the jaw inside the mask is arranged in such a position that when the performer presses it downwards with the finger or thumh the jaw opens downwards. The whole of the head is loose from the body, having a wooden stick running downwards where the neck should he. The performer takes hold of the stick through the back of the doll's chest, and by it turns the head about in any direction.

Separator for Petrol Spirit.—The size of the separator will depend on the amount of petrol (distilled petroleum) to be treated at one time. For 2 gal. of petrol construct a cylindrical tinplate vessel 2 ft. high and 10 in-



Separator for Petrol Spirit.

RETURN

Heating Incubator with Hot Water,

from a side lamp. The damper works over the top of the shaft, and when raised by the capsule allows heat to escape. By forming the shaft as shown in the illustration, direct draught is avoided. A stop tap may be inserted in the flow-pipe between the incubator and the hot-water apparatus, so that the quantity of hot water may be regulated. The water in the tank should be at 10° F. The heat of the water in the supply apparatus depends on the distance it has to travel before it enters the incubator tank, and unless the flow-pipe is insulated it will lose much heat.

Calcium Phosphide.—Calcium phosphide (chemical formula, CaP) may be prepared by heating quicklime (calcium oxide) and passing over it the vapour of phosphorus. The arrangement consists of a crucible with a circular hole in the bottom and provided with a lid; a small fiask is luted to the hole in the crucible. Into the flask pieces of dry phosphorus are carefully placed, and the crucible is filled with small pieces of quicklime, then the whole is placed in a furnace with two grates. A good heat is obtained on the upper grate where the crucible rests, and when the lime is at a white heat a small fire is kindled under the flask containing the phosphorus, which is thus volatilised, and, passing over the highly heated lime, converts it into phosphide.

Creepers on Wall to Prevent Damp.—A great deal can be said both for and against creepers growing up against a wall. Virginian creeper (especially the variety known as Ampelopsis Veitchin, having small wall roots, or tendrils, does less damage than ivy, but these creepers lose their leaves in the winter when they may be most wanted for protection. Ivy is an evergreen, keeping its old leaves on until the new ones have attained a fair size, and so makes a permanent screen against rain; but the wall roots of ivy penetrate farther than

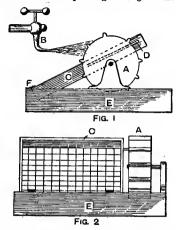
in diameter, and have a lid for it; at the bottom solder in a tinplate cone ending in a tube with a cock outside the vessel. A little higher up solder another cock to the vessel itself. The arrangement is shown in the sketch. The cock connected to the cone is for drawing off the water and dirt, and the upper cock is for withdrawing the cleared petrol.

Position of Pump Delivery Pipe.—It is advisable for the delivery pipe from a pump to empty over the top edge of the cistern or tank, and not into the hottom. The resistance to be overcome when working the pump is almost the same in each case, but there is not only the necessity of having a stop cock in the rising main to hold up the water during the time the pump lis being repaired, but also the liability of the water in the cistern running hack into the well when the pump is out of repair. When the water is delivered through the hottom of a cistern, the splashing noise made in the cistern when pumping is done away with. To prevent such noise when the water is delivered over the top edge of the cistern, the delivery pipe should be continued down into the cistern water and an air vent-pipe fixed from the crown of the bend to some height above the distern to prevent the contents being syphoned back into the well whenever the valves in the pump are defective.

Anti-fouling Paint for Boats.—An excellent composition for painting the bottoms of small boats and punts, to prevent the fouling of weeds, barnacles, etc., can be made according to the following recipe; it dries with a hard glossy surface. Over a fire melt 41b. of common resin, and remove it into the open air, and when nearly cold (just fluid) add very steadily, while stirring, 3pt. of henzine, following with \$pt. of boiled linseed oil, 11b. of blacklead, 20z. of powdered arsenic, and 11b. of zinc white paste paint. This will give a light slate colour, but may be made into a variety of shades by adding suitable paste paints thinned down with benzine. This preparation may also be used over old tarred work.

Cycle Tyre Blowing off Rim.—In trying to prevent a Palmer pattern tyre blowing off the rim of a cycle wheel, first find out the cause of its so doing. Most likely the cause is mere carelessness in placing the cover on the rim, thereby getting the air tube pinched between the cover edges; or the cover may be too large for the rim. When putting the cover on, praceed thus; put one edge of the cover on the rim, then insert the air tube; slightly inflate it and put the other edge in place, tapping the cover repeatedly with the hand as the work is proceeded with. This will help to keep the air tube in place, and before fully inflating go all round, lifting up one edge of the cover to see that the air tube is not nipped between the cover edges. The remedy for the second cause is a new rim of larger diameter. If the rim is not much too small and there is ample space for the beaded edges, putting a strip of felt round the rim in place of the usual tape might prove a remedy.

Mechanical Washer for Photographic Prints.— The accompanying illustrations (side and front elevations) show an easily made self-working washing tank for photographic prints. A is a wheel, pivoted between standards, turned by the flow of water from a bent tap B; the wheel, in revolving, lifts the tray C by means of a projection in the side passing through a slot D. The



Mechanical Washer for Photographic Prints.

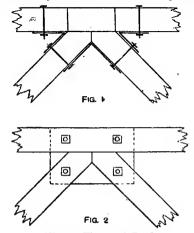
tray is hinged at F to a trough E, and the bottom of the tray consists of interlaced string, as shown in Fig. 2. The water, after turning the wheel, falls into the trough. The advantage claimed for this form of mechanical washer is that at each of its revolutions the prints are drained.

Etching Glass.—The simplest and best method of marking glasses is with a sand-blast machine, acid methods being messy and tedious. The design is cut on a stenoil; this is placed on the glass, which is then submitted to a streum of fine sharp sand blown from the machine; the design is quickly cut on the unprotected part of the glass in a ground-glass effect. The chapest way to mark glasses is with hydrofluoric acid. Cut a stenoil to the outline of the design required and place it on the glass; the remainder of the glass should be coated with etching varnish or with paraffin wax. When the stenoil is removed the design will appear on the glass, which should be supported over a lead dish containing fluorspar and strong sulphuric acid, and a slight heat applied. Hydrofluoric acid will rise from the dish and attack the unprotected part of the glass. After about half an hour the glass should be lifted and the varnish or wax removed with a rag wetted with benzene; the design will then appear in ground glass. If the latter method is adopted, the etching should be done in a fune chamber or on the hob of a firegrate, so that the acid fumes are carried away, as they are very injurious if inhaled by human beings.

Preventing Wall Papers Smudging.—Cheap papers are often printed with colours deficient in size, and therefore easily smudge, but some expensive papers smudge as easily; bright colours which by their nature would be spoilt by much size, have necessarily very little, and readily smudge or streak; colours printed one over the other, such as dark lines, are very easily moved. Block papers, or hand-printed papers, generally have their colours firmer because

better sized, but these cannot be relied on to stand the sizing brush. Most of the best papers of the chintz character will smudge under the most skilful treatment. There are distemper papers which are made for varnishing—marble tile patterns, and some pattern papers—and can with ordinary skill be safely sized on the wall; yet even such a paper would be smudged under unskilful hands. The best course in dealing with colours that are not fast is to have the paper machine sized. It is possible for lines to be hlurred slightly in the machine, but even the loosest colours, as a rule, are not moved, and a coat of size is put over the surface, safely binding all colours. Two coats can be machined on if desired, but one is enough generally. When the paper is hung, it must have another coat of size brushed on, care being taken to ruh it well into the joints; then it can be varnished.

Hipped King-post Roof.—Whenever a truss is used in a hipped roof, half trusses for the hips are necessary, or, as an alternative method, a dwarf queen-post truss parallel with the other trusses must be placed half way between the last truss and the end wall. Usually a half truss is applied on each hip, connecting the hip rafters at the king-post head to the principals by straps, as shown in Fig. 1, and connecting the tie-beams in a similar manner, with the addition of a plate on the



Hipped King-post Roof.

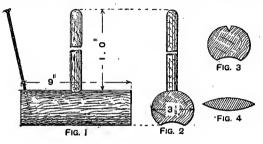
bottom, as shown in Fig. 2. The scantlings for a king-post roof truss 30 ft. span would be tie-beam 12 in. by 6 in., king-post shank 6 in. by 4½ in., principal rafters 6 in. by 4 in., braces 5 in. by 3 in., purlins 8 in. by 6 in., common rafters 4½ in. by 2½ in., straps, say 3 in. by ½ in., ½-in. bolts. A span of 30 ft. is the extreme width allowable for a king-post truss.

Scale of Measurements for Boot Lasts.—The following is a very useful scale of various lasts:—

| Ladies and Girls. | | | | | GENTS AND YOUTHS. | | | | | | |
|--|-------------------------|---|------------------------------------|--------------------------|---|---|---------------------------------------|--------------------------------|-----------------------------|-------------------------------------|--|
| Sizes. | Fittings (Joint Girth). | | | | | Sizes, | Fittings (Joint Girth). | | | | |
| | 1 | 2 | 3 | 4 | 5 | 11263, | 1 | 2 | 3 | 4 | 5 |
| 8 7 6 5 4 3 2 1 13 12 11 10 9 8 | 288777776666666555 | 188887777766666666666666666666666666666 | in. 34-12-14 34-12-14 7777 7666666 | in. 9814 888 7777 766644 | in. 99 34 24 34 34 34 34 34 34 34 34 34 34 34 34 34 | 12 11 10 9 8 7 6 5 4 3 2 1 13 12 11 | in. 994 998 888 7777 6666 | in. 9554 9844 7777 445 777 445 | in. 10 99 99 88 88 77 77 63 | in. 101 10 95 11 99 88 88 8775 11 7 | in. 1011 10 915 11 9915 11 881 88 8 771 11 |

Finding Pitch of Roof.—The method of calculating the pitch of a roof when the span or rise is given is as follows. When the span and rise are given, the pitch (a) will be rise. (For example, 24 ft. span 6 ft. rise $=\frac{6}{24}=\frac{1}{4}$ pitch); or (b) will be a slope of $\frac{1}{2}$ span to 1 (for example, in the given case $\frac{1}{6}\times \frac{24}{6}=2$ to 1); or (c) the pitch in degrees will be the angle whose tangent is $\frac{\text{rise}}{\frac{1}{2} \text{ span}}$ (for example, in the given case $\frac{6}{\frac{1}{2}}\times \frac{24}{24}=5$, which is the tangent of an angle of 26° 33').

Tools for Splicing Wire Ropes.—A serving mallet employed in splicing wire ropes is shown in elevation and section respectively by Figs. 1 and 2. The stock of the mallet should be of ash or other hard wood with a 2-in, groove in the base (see Fig. 2). The handle can be made of any wood. A piece of rod iron (see Fig. 1) about 4-in. in diameter is driven into the front end of the stock for the bobbin to go on, and a small V (see Fig. 3) is cut out of the front end of the stock for the spun-yarn to pass over. The bobbin should be made of close-grained wood, the finished size being 8 in. high by 6 in. wide. It is not indispensable, however, for the ball of spun-yarn could be passed over the rope by an assistant. For large ropes such as 7-iu. or 8-in. cir., a larger mallet would be required. The flat spikes or tuckers should be made by a local blacksmith. For ropes about 3-in. cir., get a piece of round steel rod, \(\frac{1}{6}\) in. in



Serving Mallet for Splicing Wire Ropes,

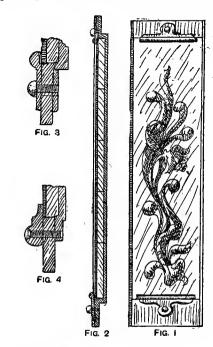
diameter by 16 in. long. Leave half its length round for the handle, and draw out the other half to the form of Fig. 4 for the blade. Make it \(\frac{1}{2} \) in. at its thickest part and gradually taper it off to a point. A cross-piece on the top of the handle is useful for turning a spike on its edge if necessary. The top of the handle should be square shouldered, a corresponding hole being made in the cross-piece and the two securely riveted together. If much splicing that involves a number of different sizes of ropes has to be done, it will be advisable to have a set of different sizes of spikes made.

German Yeast.—German yeast, originally imported from Germany, now comes from Holland, but the greater part is made in the United Kingdom, and the name is not now properly German yeast but dried yeast. Dried yeast is a product of the manufacture of whiskey, and it will not pay to make it anywhere but at a distillery. It is produced by making a mash of barley similar to that for beer, and fermenting it by the addition of yeast; during the fermentation, the yeast, which is a low form of plant, grows at an enormous rate, and comes to occupy a much greater bulk and weight than when it was originally put in. A portion is taken off to add to the next mash; the remainder is washed, pressed, and put in begs for sale. This is quite a secondary trade, because the mash is the principal product; subsequent to fermentation it is distilled for the production of a spirit, which, after maturing, is known as whiskey.

Oxidising Iron.—One method is to dissolve chloride of bismuth 1 part, bichloride of mercury 2 parts, copper chloride 1 part, in hydrochloricacid 6 parts, alcohol 5 parts, and water 5 parts. Thoroughly cleanse the articles to be oxidised in a soda bath, then dip them in spirits of wine and dry. Afterwards dip them in the above preparation, or apply the preparation with a brush, and again allow to dry. The articles should then be boiled for half an hour in boiling water. If they are not then quite black enough, two coats should be given. The second method is as follows. Make a solution composed

of ferric chloride crystallised 2 parts, solid butter of antimony 2 parts, gallic acid 1 part, and water 5 parts. Dip the articles in this solution, and afterwards dip in dilute hydrochloric acid or sulphuric acid; allow to stand for twenty-four hours, then remove the coat with a steel wire brush. Repeat the operation several times. When the articles are black, dip in linseed oil and heat over a clear fire to a red heat, and finally rub on linseed oil. A third method is to make a solution of potassium bicarbonate 1 part in 10 parts of water. Immerse the articles in this, dry them in the air, and afterwards hold for about two minutes over a clear fire. Repeat the operation. Any shade to an intense black can thus be obtained.

Fixing Copper Panels to Tiled Firegrate.— The easiest method, provided the grate is only set, not built in, would be to remove the tiles, and fix the panels in their places. But if the grate is fixed, the plan shown by the accompanying illustrations might be adopted. Fig. 1 shows the copper panel in place. It must be



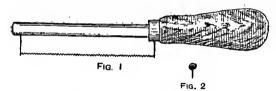
Fixing Copper Panels to Tiled Firegrate.

cut to fit the opening between the moulding on the front of the grate and the inner front, so as to fit tightly with a little pressure. It may be kept in place by an ornamental piece of iron, brass, or copper fixed with screws to the top and plinth of the sides of the grate in which the tiles are set. Fig. 2 is a section showing the copper plate resting on the tiles and held in position by the ornamental plates. Fig. 3 is an enlarged section of one end of the plate. To fix the panel, a hole is drilled into the cast-iron portion, and then tapped. The ornamental plate is placed against the repoussé plate, and screwed in with round-headed screws. Fig. 4 is a sectional view showing the plate held in position by pieces of ordinary ogee moulding screwed to the iron portions, as described above. There is no arrangement with cement that would be satisfactory and also enable the reponssé panels to be removed without damaging the tiles.

Fixing Brass Inlays on Workboxes, etc.—Brass corner plates, etc., can be fixed with good boiling hot glue. When the glue is nearly boiling, pour into the pot about a tablespoonful of rectified or Venice turpentine to the pint, and stir it well into the glue. To prepare the inlays, scratch the under side with a wire scratch-brush or a fine bradawl, then dip the brass into a sancer of vinegar to remove all grease, being careful when lifting it out not to touch the under side with the finger. Now wash the brass in hot water to remove the acid, fill in the sinking with hot glue, and press the veneer down, rubbing with the hammer face made hot in boiling water.

Japanning and Gilding Iron Frames for Pianos.—High-grade finished frames are got up by japanning, for which purpose a japanner's stove or oven is required. The necessary groundwork materials and varnishes are seldom made by the user, but are procured through a varnish maker. The iron frames are primed by a mixture of copal varnish and zinc or flake white, each coat baing smoothed down, the first and second coats by glasspaper, and the succeeding coats by pumice powder and water. When the groundwork is perfectly smooth, it is bronzed, then varnished. The varnished surface being subjected to heat for some hours at a temperature of from 250° to 300° F. causes the gums, resins, etc., of which the varnish is composed, to liquefy; the solvent evaporates, and the gummy residue adapts itself to all inequalities. If the body of varnish is sufficiently dense, the result will be a uniform and glossy surface. Six or more successive coatings may be necessary before a high-grade finish is obtained: the varnish used after bronzing must he perfectly clear. In the majority of cases, the surface gained by heat will suffice. In special cases, however, the portions most exposed to view—that is, around the wrest-plank—are sometimes finished by rottenstone and chamois leathers. The requisite heat and length of exposure vary slightly with the quality of materials used, and must be ascertained by experiment.

Fitting Raised Frets into Banjo Arm.—For substituting raised banjo frets for smooth frets, a special German silver wire, known as fret wire, is used, and where the sunk or smooth frets are now situate channels for its reception can be cut with a metal-worker's fine saw; Fig. 1 shows a suitable saw. The bottom edge of the flat portion of wire (see Fig. 2) where it is inserted in the wood should be roughened like fine saw teeth to grip better, and prevent slipping out. This can be accomplished by hacking it with a chisel or sharp tail-end of a



Fitting Raised Frets into Banjo Arm.

hammer, the wire meantime resting in a groove along a piece of hard wood. The wires should be cut off a trifle longer than required, the ends being trimmed off and the top edges slightly rounded after they have been fixed in position; run thin hot glue into the channels first.

small Castings in Brass and Aluminium.—
The general methods of making small castings in brass and aluminium are substantially the same. To melt the metal, a furnace will be required. This may be of any size, according to the weight of each melt. The average melt or heat in brassfounding is from 55 lh. to 60 lh. This in aluminium would only weigh from 18 lh. to 20 lh., since aluminium is roughly only one-third the weight of brass. A furnace to melt the above quantity of metal should be 11 in. square in section, having a depth from draught hole to fire-bars of about 24 in. This will give ample depth of fire and sufficient distance from the top of the crucible to the draught hole for good working. The crucibles or pots should preferably be of plumbago. Although the first cost of plumbago is rather dear, it will prove cheaper in the end, since upwards of forty heats may be obtained from a single pot, which will average about 13d. per heat of 60 lh. Clay pots may he used, but are not so satisfactory, while for aluminium, plumbago is next to indispensable owing to the aluminium absorbing silicon from the clay during melting. The moulds in ordinary hrasstounding are made from sand or loam; this is either green sand or dry. A suitable sand is ordinary red sandstone. For aluminium the same procedure is followed, except that larger gates are allowed owing to the greater shrinkage of the metal when cooling. The usual alloy for brass castings known as yellow metal is 60 lb. of copper to 40 lb. of zinc. This is never made from all new metal, as unetal that has been previously melted gives a hetter result than virgin metal. The general plan is to use a quantity of new metal, say to a quarter heat, that is, 15 lb. of copper and 12 lb. of zinc, to cover the loss of zinc during melting, the balance of the heat, to say 60 lh., being made up of scrap metal (brass), the necessary weight being 33 lb. It is a good plan to add \$1 lb. to 1 lb. of lead to the melted brass when pouring; great

care, however, must be taken that the metal is well stirred up, as lead has a tendency to settle out. The lead heing uniformly mixed, the castings will be found to turn very much freer and will take a good finish. If a strong metal is wanted, a little iron may be added, but this will make the castings much harder and more difficult to work up. The crucible of metal must not be allowed to remain long after melting in the furnace, for not only will there be a considerable loss owing to the zinc burning away, but the metal will also have a tendency to become somewhat rotten owing to hurning or overheating. The aluminium can be melted in the same furnace, but the heat necessary will only be cherry red, dark in colour. The metal will not stick to the pot, and when melted will still have its metallic colour, silver-looking in appearance; in fact, if the metal did not move in the crucible, one might conclude it was still unmolten. This is the really difficult thing in aluminium casting, since if the metal is got only a little hotter than is necessary it is liable to be spoilt by becoming porous or spongy. The method of pouring aluminium is the same as for hrass. If the aluminium is required to be slightly hard and more durable, add to it about 6 per cent. of copper. To do this, an alloy of equal parts of copper and aluminium is made, and then the right weight of this alloy is added to the molten aluminium.

Air-gun Case.—To make a strong wooden case for an air-gun, place the gun on a board, and measure the length and breadth required, in this case 2ft. 9in. by 4½in. Then at the stook place blocks of wood, one block at each side, to get the depth, and allow ½in. extra. The depth can easily be seen by resting a lath on the blocks. The case may be made from ½in. stuff planed to ½in. Having found the thickness of the bottom, cut two ends, and nall them to the bottom. The ends are 4½in. by 2½in., and the sides 2ft. 9½in. by 2½in. A lid covers the whole, and has ½in. fillets nailed on the ends to keep tif from twisting. A pair of 1½in. brass butts, and two side hooks and syes to fasten, with a brass handle, will complete the case as far as holding the gun is concerned. But to keep the gun from shitting inside, a piece A (see the illustration) of ½in. stuff is put flush with the top



Air-gun Case.

over the stock, and two boxes B without bottoms are made, the barrel of the gun going between them. A block, with a circular recess cut out to take a box of slugs, is fitted at C. The boxes B are to be ualled to the bottom, and will hold the darts, extractors, a file to true up damaged darts, and a few leather washers. A piece of wood D, 4\frac{1}{2}\text{in. by }\frac{1}{2}\text{in. hy }\frac{1}{2}\text{in. pivoted at the end of one box by a screw to go across to the other side into a shallow slot, would prevent the barrel moving, and would also keep the lids of the boxes shut.

shallow slot, would prevent the barrel moving, and would also keep the lids of the boxes shut.

Carburetters for Cycle Petrol Motors.—The carburetter employed with a cycle motor is for generating the gas from the petrol just before it enters the cylinder of the engine. Carburetters are of various types—spray, wick, surface, and combination spray and inlet valve in one. The spray, the most general and popular form, is a small metal casing having two compartments, one of which is fitted with a needle valve operated by a float which regulates the flow of petrol from the tank; the other compartment is the mixing chamber, into which the petrol is drawn in the form of a spray by the vacuum caused by the induction stroke of the piston. This spray of petrol, mixing with a suitable quantity of air admitted at the same time into the mixing chamber, forms the gas, to which then is added, as a rule, a supplemental quantity of air, and the explosive mixture then passes to the motor, and is exploded at the correct time. The wick form of carburetter is a very simple affair, consisting of a metal tank containing the petrol into which a wick is inserted, the wick supplying the necessary petrol vapour to the mixing chamber. This form of carburetter is not much used. The surface form of carburetter is not much used. The surface form of carburetter is not much used. The surface form of carburetter is a suitable metal petrol tank having a perforated air tube inserted so that the perforations are below the level of the petrol surface. The air let in through the upper end of this tube hubbles up through the petrol, thus mixing with the vapour and producing the gas. This form was much in use till recently, but is being superseded rapidly by the spray. The combination is perhaps the most simple of all, and is merely a small chamber immediately connected with the inlet valve, into which the petrol is sprayed and mixed with air.

Refined Medicinal Cod-liver Oil.—Pure cod-liver oil Refined Medicinal Cod-liver Oil.—Pure cod-liver oil used for medicinal purposes is made from perfectly fresh cod livers as soon as possible after they have been removed from the fish. The livers are at once placed in steam-heated pans, and the oil which is removed by the heat is drawn off as quickly as possible. By this means the decomposition products due to putrefaction or to overheating which were at one time present in cod-liver oil are now not formed, and a pure, almost white and not unpleasant oil is the result. Refining by ice is carried out by allowing the oil to stand in tanks in a cold room until the solid fat or stearln and suspended impuritles settle out, when the clear oil is decanted.

Contractor's Cart.—Fig. 1 shows a useful pattern of contractor's cart on springs to carry from 10 cwt. to 12 cwt. The width over the bottom sides may be 3 ft. 41n., the length on the floor in ide 3 ft. 101n., and the total length of the top rave 5 ft. The raves may be of 1½ in. by 1½ in. stuff, the bottom sides 3 in. by 2½ in., the hind bar 3½ in. by 3 in., and the standards 1½ in. by 1½ in. The shafts should be 3 in. square at the root, tapering to ½ in. deep by 2 in. at the point. The total length of the shafts

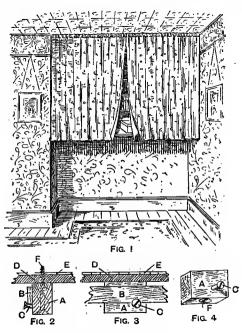
SPECIFICATION OF THE SECOND Fig. I ם FIG. 2 Contractor's Cart. <u>a</u> FIG 3

should be about 8 ft., the distance from the tip to the cross bar being about 6 ft. 6 in., and the width at the collar 2 ft. The wheels should be about 4 ft. 6 in. In diameter over the tyres, with raves about 11 in. by 10 in.; the spokes should be 2½ in. by 1½ in., the felloes 2½ in. deep by 2½ in. wide, and the tyres 2 in. by ½ in. The springs may be 3 ft. 6 in. long with a sweep of 4 in., and have six plates of 2½ in. by ½ in. as a have six may be used, let into an oak axle bed 4 in. square. Suitable scroll irons may be obtained with the springs if the load the vehicle is expected to carry be stated. Fig. 2 shows a side elevation, and Fig. 3 a plan of a suitable screw brake for the cart. A small brake wheel A is connected to the front standard by a bracket B. A½ in. serw is keyed to the wheel and works in a wing nut 0, and this is connected by a pull rod D to a lever E, which is welded to a rocking shaft passing across the vehicle underneath the bottom sides. Levers G are welded at both ends of the rocking shaft as shown, and the brake blocks H are connected to this by means of a plate and coach screws, or by other suitable methods. The centres of the blocks must coincide with the centres of the tyres, and the shaft is secured to the under side of the bottom sides by brackets I.

Brazing Cycle Tubes.—It is sometimes advised to punch the peg hiles in a cycle tube. Now this is next to impossible with a butted tube, and, if accomplished, would dent the tube. If a liner is used the same would happen. Drill the hiles if necessary, making one hole at each side. Blacklead

should be put on the tubes, as close to the joint as possible, and the borax should be used very sparln ly. Mix the blacklead with water; when mixed with oil it spreads into the joint. The bracket tubes should be brazed in first, as these are the main tubes. When this is done, the top and head tube can be brazed without fear of any part moving. Heat the lugs only; the tube need not get hot farther than in from the top of the lug. If pure lump borax is used, it must be burnt off. Powder it as small as possible, and put it on a piece of sheet iron; then blow under the iron with the blowpipe until the borax stops bubbling up, when it is fit for use. Although borax may be employed for welding iron, it is of very little use for preventing steel burning, and should not be put on the tubes more than can be avoided.

Supporting Recess Curtains.—In most households things accumulate that require putting out of sight, but at the same time there is no spare cupboard or drawer room. When this is the case, a good plan is to fix shelves in recesses of bedrooms or along short walls, and have curtains in front

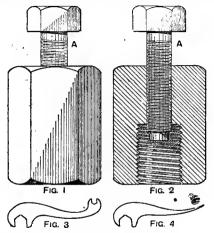


Supporting Recess Curtains.

of the shelves, the curtains being hung on a rod, and the rod supported by wood blocks which are fixed to the celling (see Fig. 1). It is somewhat difficult if, when fixing the supports to ceilings, the joists are not in favourable positions, but the supports may be screwed to plastering laths. Fig. 1 shows the curtain reaching to the ceiling, and the length of the curtain is regulated according to the position of the curtain shelf, the curtain hanging lin. or so below the shelf. A hem (sufficiently wide to take the rod) is formed on the top edge of the curtain. This does not draw in the usual way with rings; when anything is required from the shelves the curtain is lifted up or aside. The block A (Figs. 2, 3, and 4) is held by the screw F, which is driven into the plaster lath E through the plaster D. In fixing the block to the ceiling, a sharppointed gimlet must be used to bore a hole in the lath. If much pressure be applied, the lath will lift; therefore care is required in making the hole. The blocks may be about 2) in long, 2in. deep, and 1½ in. thick. Window-blind laths are usually about 1 in. by § in., and may be used for the curtain rod B (Figs. 2 and 3). The top edge of the rod, when resting on the screw C (Figs. 2, 3, and 4), should he about § in. from the ceiling. If the curtains are about 5 ft. wide, two blocks fixed about 6 in. from each end of the recess will be required. When finished, the rod with curtain is simply lifted on the screw C; and as the curtain completely hides the blocks, no particular finish is required for the latter. Suitable materials for curtains are cotton damask, muslin, and very thin cretonne.

Altering Colour of Mailcart Hood — American leather cloth, being a waterproof material, cannot be dyed. But a brown colour can be altered to blue by using a dressing, such as a varnish stain or enamel. The following will be found suitable. Dissolve in a water hath 1 oz. of powdered borax and 3 oz. of orange shellac, then add ½ oz. of indigo blue and, when warm, ½ oz. of glycerine. Give two coats with a swab of soit rags or sponge. Or dissolve ½ 1b. of gum arabic and ½ oz. of gine in ½ pt. of water, add 4 oz. of brown sugar and ½ oz. of indigo blue, and apply warm. The indigo can be bought at the druggist's, and costs about 6d. an ounce. The leather can be glazed with equal quantities of well-beaten white of egg and good gum. Experiment with the dressing on a waste piece of leather before applying it to the mallcart.

Improved Stud-block.—The stud-block shown in Figs. 1 and 2 is no more difficult to make than is the usual kind. The new feature in its construction is the substitution of the left-handed set-screw A in place of the ordinary right-handed one. The advantage of this new design is that, to release the stud-block, it is only necessary to turn this set-screw in a right-hand direction, tending to secure the stud still further, thus rendering it unnecessary to hold the block with a spanner to prevent the stud loosening. The end of the spanner used for the block can be a fit for the set-screw, as shown in Fig. 3, or it may be made into a tommy-bar (Fig. 4) at the end, fitting a hole in the



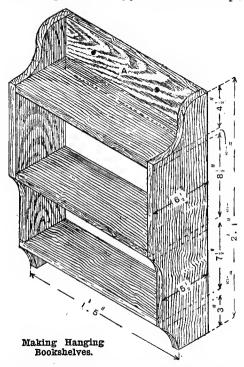
Improved Stud-block.

set-screw. To make the stud-block, cut off a length of hexagonal wrought iron or steel bar, hold it in a three-jaw chuck, and drill a hole the tapping size of the stud to be operated on, and extending about half-way through. Then continue the hole right through, the drill this time being the tapping size for the set-screw. Now thread the piece with a tap the size of the stud at one end, and with a left-hand tap at the other end to take the set-sciew. This set-screw had better he threaded in a screw-cutting lathe. Fit up this serew with a hexagonal head, or a cylindrical head with tommy holes. In use, this stud-block is screwed down on the stud in the usual manner; then, when the stud is tight, simply screw the set-screw in a right-hand direction, and the block becomes released.

Common Yellow Soap.—In making common yellow soap, there will be required the following materials. Tallow and cotton-seed oil (equal parts) about 55 pt., resin 15 pt., and caustic soda 11 pt. to 12 pt. These ingredients are saponified in the usual way, a soda lye being made by dissolving the soda in water to form a solution with a specific pravity of 1'075 or 15° Tw. Silicate of soda is mixed with the soap in a mixing or "crutching" vat at a temperature of 160° F.: the temperature is allowed to fall to 150° F., and the soap is then run into the moulds. The quantity of silicate of soda used will depend on the kind of soap required; from 101b. to 501b., or even an equal weight of the soap can be added. The strength of the silicate solution is about 1'45 specific gravity or 90° Tw.

Fixing Brass Stair Treads on Stone Steps.— Here are instructions on making and fixing a brass stair tread with rounded nosing on a square stone door etep. The brass must be first "planished," that is hammered all over with a steel hammer having a large face; this stiffens and hardens the brass, and also takes out any irregularities, such as sinkings or twists. The side of the nosing must then be clamped on the bench, and bent round a rod to the shape required. It is now gone over with a flat file till the surface is smooth, and then polished with a float, using flour emery, finally finishing off with crocus powder. This work can only be successfully accomplished by a whitesmith who possesses the necessary tools and appliances. The proper method of fixing the brass is to drill and countersink holes in it, mark their exact position on the stone step, and cut dovetail holes about lin. deep and \$\frac{1}{2}\$ in. wide. Place the brass screws in the holes, and run them with lead; now take out the screws by unscrewing in the usual way, fix the brass nosing in position, and screw into place.

Hanging Bookshelves.—The accompanying sketch gives a design for a set of light hanging bookshelves which can be made from \(\frac{1}{2}\)-in. whitewood, of which seven pieces are required. The top piece \(\text{A}\) and a bottom piece

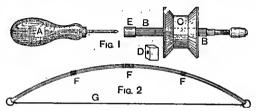


project lin. beyond the shelves, keeping the books from the wall, and leaving an air space at the back. The appliance is hung on two brass headed nails, or by means of small brass plates, and is stained walnut, and varnished.

Testing Wheatmeal Bread.—If carbonate of soda and sulphate of copper are suspected to be present, they are best tested for in the ash. Burn some of the bread in an open porcelain dish over a Bunsen burner, extract the residue with hot water, and evaporate the solution to dryness, then add dilute hydrochloric acid; if the residue effervesees, hold over the dish a glass rod having a drop of lime water on it; if the lime water is rendered turbid, the gas evolved is carbonic acid, and carbonate of soda is most probably present. To test for sulphate of copper, burn another portion of the bread, add water and two or three drops of dilute hydrochloric acid to the residue, then place a bright needle in the liquid. If copper sulphate is present, the needle will be covered with copper in a short time. In bread baking yeast is usually employed for raising the bread, and unchemicals are used; but if baking powder is employed, then the bread will contain the tartrates of soda and potash, and on burning these will be converted into carbonates. Baking powder consists of hicarbonate of soda, cream of tartar or tartaric acid, and ground rice. Carbonate of soda alone is only used in special cases, as in "soda" scones. Sulphate of copper is never put into bread.

Re-covering Perambulator Hood.—Perambulator and mailcart hoods are covered in all kinds of materials. However, American covered leather is mostly used: and this is now manufacured in beautiful colour shades, is waterproof, and can be bought up to 2yd wide. Its chief defect is that the enamel surface is susceptible to scratchea and cracks, which cannot possibly be nemoved. A stout variety specially suitable for hoods is known as "American duck." Common roan skins are used in better-class perambulators, and wear well, being supple, and keeping a good appearance. Coloured satins, sateens, and even silks are employed on some of the lighter-class mailcarts, but are not suitable for damp or wet weather. A hood cover generally consists of four separate pieces, namely, back, two sides, and top, which are joined together with welted seams; these pieces are cut from carefully measured templates. For re-covering, the best plan would be to take off the old hood covering, rip the seams, and cut the new material to pattern, due allowance being made for seams. The cover is tacked to the body border and to the front hoopsticks, the tack heads being hidden by a coloured gimp or leather bauding.

Converting Pinvice to Fiddle Drill.—In Fig. 1 A represents a fine bradawl, B a pinvice (or pin tongs) having a hollow fluted shank over which has been forced a common white-wood bobbin C, on which ordinary sewing thread has been wound. A small plug D of hard brass or steel fits tightly into the slot in B shown at the side of the bobbin. In D a small hole is bored, as shown, to a depth of \(\frac{1}{2}\) in. The bradawl blade, after being filed to a point, passes into the open end of B and comes in contact with the plug D, so that B may turn freely on the point of the bradawl blade. A metal cap E may be fitted into the end of B to prevent splitting.



Converting Pinvice to Fiddle Drill,

The bow (Fig. 2) consists of three umbrella ribs bound together by means of fine wire bands F. The bow string G is attached to the ends of the bow by means of the end loops formed by twisting together the loose ends of pieces of wire and passing these through the holes in the ends of the ribs. Motion is imparted to the drill by passing the bow string twice round the bobbin, and drawing the bow horizontally backwards and forwards as in violin playing.

Fire Risks with Acetylene and Calcium Carbide.

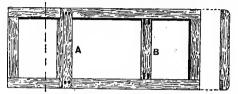
—Carbide of calcium has given no trouble whatever when in contact with any element, excepting water. With water it decomposes rapidly, producing acetylene and a residue of slaked lime with excess of water. Carbide can be subjected to fire heat with perfect safety. It is, however, so snsceptible to moisture that it must be kept in air-tight receptacles, but even it allowed to get moist the carbide is not dangerous; it is only the gas (acetylene) that is given off that can cause trouble when out of its proper place. Acetylene is no more dangerous than coal gas, but unburned gas must not be allowed to escape into or collect in places wherea naked light is taken. There is no evidence that acetylene is explosive when in contact with anything that is below a bright red heat. The only metal that has to be avoided is copper. Undesirable compounds have been formed when acetylene and copper were long in contact, and although this is not always the case, it is the rule not to use copper. The alloys of copper, brass, and gunmetal may be safely used.

Glycin Developer for Photographic Negatives,
—Glycin is a developer that is slow and weak in
action, and quite unsuitable for studio exposure. The
chief recommendation of glycin le that it may be left to
work automatically—that is, it may be employed for
stand development when the plate can be left for a
long time unattended. Though to a professional worker
glycin is not of great interest, it produces good work,
Good work can be done, in fact, with any developer; success is more dependent on experience than on a particular
developer. The formula given below will be suitable for
portraiture. First make up a stock solution hy dissolving 350 gr. of sodium aulphite in 20z. of hot water, add

150 gr. of glycin, and heat to boiling point, then add gradually 14 oz of carbonate of potash. For use, dilute the stock solution with ten times ita bulk of water. Always well shake the stock solution before measuring.

Infusorial Earth.—Infusorial earth is a light friable earth found in various places, especially in Richmond, U.S.A., in Tripoll, and in Norway and Sweden; it is also found in peat bogs in Ireland and Scotland. Infusorial earth is formed largely of the silice ous skeletone of very minute water organisms. The infusorial earth from Tripoli is called tripoli powder, and is used for polishing purposes; the deposits in the United States are also used for polishing purposes, and are called ellica. The deposits in Norway and Sweden are called theselguhr, and aometimes berg mahl, which means mountain meal. Kieselguhr is the best known infusorial earth; it is used for the preparation of non-conducting coatings on steam boilers and steam pipes, and for refrigerating plant; also as an absorbent for nitroglycerine, the product being dynamite.

Fixing Candle Sconces to Fretwork Front of Piano.—Old-fashioned piano fronts with fretwork may have the frets the whole length or divided into three compartments. The silk or other material behind these frets is generally on a separate frame of thin wood. These frames may be simply formed of four strips of wood, in some cases one or two extra struts being let in. Where the top-door frame of a piano has no intervening bars, or the silking frame has no struts on which candle sconces may be acrewed, in order to bring the lights nearer the music desk than is possible when sconces are put on each end of the top door, take the door out, place it face downwards, and fix two strips of wood A (see aketch), tin. thick and 2½ in. wide, their exact positions being determined by the distance the sconce must be fixed from each end, or by the location of a



Piano Top Door Frame.

portion of the fret design that will let the back socket of the sconce bed firmly against it. If the strips A are found to be too thick when the door is replaced in position, so that the hammer head strikes against them, they may be hollowed out at the point of contact till freedom is assured. If, however, the damper wires come into contact with these strips, put in thinner strips, not halved, but cut just the length to fit tightly, and secure them in position by 1-in, fine nails or panel pins, as shown at B, taking care in so doing that the strips do not force forwards and break the frets. If there is no silking frame, the frets will not be broken.

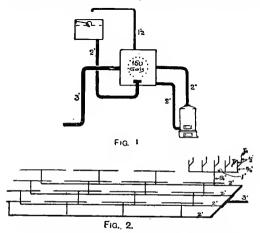
. White Enamel Turning Yellow.—This is due to the zinc oxide in the composition turning yellow on exposure to the air. The varnish used in the preparation of the enamel also has a tendency to turn yellow. To prevent this, thoroughly mix into the enamel a very small quantity of finely ground ultramarine blue mixed to a thin consistency with turpentine. This will counteract the yellowish effect, which appears with age, and if not added to excess will dry out a good white.

Repainting Clock Dials.—In repainting clock dials the figures and minute marks can be traced on tracing paper, before the dial is cleaned off, and transferred to the new white painted surface by laying a sheet of black carbon transfer paper between the tracing paper and the dial. The ordinary black and white enamels sold in small tins for decorative purposes will do very well as paint.

Fixing Tiles in Range Openings.—The only really satisfactory method of fixing ornamental tiles in range openings is to nip a little piece off the corners of each tile, and then, as they are put up, cement in a brass-headed nsil (with the nail split or bent) where the corners of four tiles come together. Ordinary cement is then used, the backing being well made and wetted, and the tiles soaked in the usual way. Plain iron covings with the tiles secured by corner screws is the only perfectly successful way of tiling round range openings. In every case there should be a 7-in. or 8-in. iron skirting round the hot plate to prevent the tiles being struck by saucepana, etc.

Testing Qualities of Brioks.—The most important properties of a brick are its strength and its resistance to atmospheric weathering. The strength of a brick is determined by compression in an hydraulic press; the pressure applied per square inch is calculated by dividing the total pressure required to fracture the brick by the area of the face of the brick. A good brick will withstand a pressure of 2 to 3 tons per square inch without fracturing. A test of the weathering properties of a brick may be measured by determining the amount of water the brick will absorb. In order to carry out this test, place the brick for one day in an oven which is kept at a temperature of 100° C; then take the brick out, weigh it, and place it in a bucket of water. The brick is left in the water for twenty-four hours, then removed, wiped with clean cloths, and again weighed; the gain in weight shows the quantity of water absorbed by the brick. A brick, therefore, that absorbs a considerable quantity of water possesses very poor weathering qualities.

Hot-water Apparatus for Long Ranges of Washbasins.—The accompanying illustrations show a method of supplying long ranges of wash-basins with hot water. Fig. 1 shows an independent boiler and tank, and Fig. 2 shows the piping to the basins. The boiler should be a No. 5 or No. 7 dome-top (or the equivalent in any other pattern). A No. 5 boiler will heat the water in about two hours and a half, while the No. 7 boiler will



Hot-water Apparatus for Long Ranges of Washbasins.

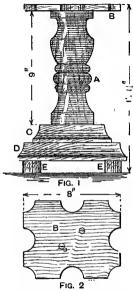
do the work in about one hour and a half. If preferred, the boiler can be dispensed with, and the contents of the tank heated by steam, either free steam or a coil being employed. The piping to the basins is arranged on the supposition that one 3-in. pipe runs along beneath each range; from these pipes vertical 1½-in. branches are taken, four branches to each range. The pipes again branch horizontally right and left, while these subtranches again branch and terminate with ½-in. taps. The complete detail is shown in the top right corner of Fig. 2.

Fig. 2.

Printing on Copper from Photographic Negative.—Prepared bitumen is powdered and dissolved in benzele (which must be quite free from ether) to a consistency resembling ordinary thin collection (that is, the solution must flow freely); to each 200 parts of the solution is added 3 parts of Venice turpentine. Thoroughly polished copper plates are coated with this solution; the film must be extremely thin. The plates require about twelve hours to barden. Before placing in the frame the plates should be dusted over with French chalk in order to prevent the possibility of sticking. The exposure varies, of course, with the transparency of the lines and the strength of the light. The lines should be as clear and free from deposit as possible, with an exceedingly dense background. Perhaps half an hour in bright sunshine may suffice. Develop with equal parts of benzole and turps. Add the benzole very sparingly, as too much will dissolve both the soluble and the "insoluble" parts. When the soluble parts have been removed, the plates are placed in a dish (a size larger than the plate) and etched with nitric acid baths of varying strengths, beginning with weak solutions and gradually increasing. The first baths should not be so strong as to cover immediately with bubbles a plece of

zinc placed in the bath; if this happens, the bath should be diluted. A bath may be allowed to act for some time, and then be succeeded by a bath about three times as strong until the etching is deep enough to form a decided roughness. Only experience can teach how far to etch. The better plan is to proceed slowly with weak baths rather than to use a few strong baths. When etched the plate is cleaned with turpentine and polished with sawdust. Several etchings are employed for fine work. The back of the plate is coated with a protective varnish. The process is much too lengthy to explain in detail. Such work is done commercially at a very low rate, and much more cheaply than an amateur could hope to do the work, which, too, is unsultable for amateurs.

Piant Stand or Pedestal.—For the plant stand shown by Fig. 1, the central pillar A is simply a length of 9 in. cut off an old newel from a staircase. Its diameter may be 3½ in., and no preparation is needed beyond cutting the ends straight and smeoth across. The top B (Figs. 1 and 2) is formed of teak, ½ in. thick when planed, and is 8 in. by 5½ in. wide. The half circles were cut out with a turning saw, and finished with rasp and glasspaper. Two screws attach the top to the pedestal, and prevent the top turning round. The



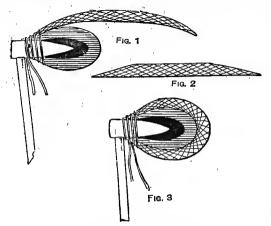
Plant Stand or Pedestal.

hase is formed of l½-in. deal, the ends and sides being hollowed out with chisel and gouge, and finished with a half-round rasp and sandpaper rolled round a tool handle. The base is in two sections, the upper one 0 (Fig. 1) measuring 3½ in. by 5½ in. at the top surface, and tapering out to 4½ in. by 6½ in. at the bottom. The lower section D measures 6½ in. by 8 in. at the top, and tapers out to 7½ in. by 9 in. at the bottom. Four feet E, each 1 in. long, and cut from an ash faggot stake 1½ in. in diameter, are affixed to the bottom of the pedestal, one at each corner. The whole is held together by screws and given two coats of walnut-coloured varnish stain. All ends where the grain of the wood is exposed should be coated with size before applying the stain.

Lime Concrete.—For making lime concrete, the composition of which is to be 3 of sand, 5 of gravel, and 1 of lime, all the ingredients should be measured in a gauge-box, one box full of lime being mixed with three times that quantity of sand and five times that quantity of gravel. The lime must be freshly burnt, and ground to a powder in a mill. The lime can be bought in this condition, put up in bags like Pottland cement. The usual method of making the concrete is to measure out on a mixing floor the sand, lime, and gravel, mix them by turning them over twice with shovels, and turn over once more while the water is being poured over the heap through a rose. The wet mass must be carried away at once and deposited in position while the lime is hot. Sometimes the lime and sand are first mixed into a mortar, the gravel then added, and the whole ground in a mortar mill.

Removing Paraffin Stain from Mackintosh.—To remove a paraffin oil stain from a mackintosh, first make a dabber by placing a ball of cotton-wool inside a cloth and screwing it up, then apply benzoline to the dabber until it is soaked, and with it go well over the stain; afterwards, rub well with clean cloths and allow to dry. If the stain is not removed by the first application, repeat the operation.

Re-covering Piano Hammers.—Piano hammer heads must he re-covered one by one, and great care is required. The felt is supplied in strips about 45 in. long, 3 in. wide at the bass end and 2 in. at the treble, and graduating in thickness from \(^1\) in. to \(^1\) in.; it is sold in various qualities. Before use, it must be skived into shape as shown in Fig. 2, then cut into segments about \(^1\) in. wide, giving about eighty-five or eighty-eight pieces as required. The hammer heads are generally \(^1\) in. wide, and the extra width given to the felt segments allows for overlaps on each side, which must be trimmed off with a sharp knife after the glue is set. The action must be removed from the instrument and laid across a table, hammers upwards. Then with a sharp knife cut through the old coverings where they strike the wires, taking care not to cut the under-coverings or woodwork. The old felt can then be readily pulled off. The new felt, which is cut up, should be left on a board with the segments in sequence, and should be put on with fresh-made Scotch glue, the hevelled side being put on the hammer head. In repairing shops spring clips are used to hold the felt till the glue has set, but as a makeshift very narrow tape or



Re-covering Piano Hammers.

thin twine may be used, as shown in Fig. 1; this illustrates one end only of the felt-secured, which is the correct method, though it is not uncommon to secure both ends at the same time, as shown in Fig. 3. Owing to the limited space between the hammers for working and the liability of the trying material to become entangled, alternate hammers should be operated on, starting at the bass end, and by the time the treble end is reached some of the tapes may be removed for use on the other set. The felt should not be heavily coated with glue at the point forming the back of the striking part; in fact, the less the glue at this point the better. The hammers at the treble end being smaller, have only a single lining between the felt and wood. If the felt is stretched fairly tight over the hammers it may have the effect of brightening the tone.

Sizes of Pipes used in Steam and Hot-water Heating.—No brief data on the sizes of pipes used in steam and hot-water work can be supplied. Text-books contain tables, but as each "system" of work requires different tables the whole would occupy considerable space. The two tables here given relating to the most commonly adopted systems of work may be of service. No rules or formulæ dealing with the distance of the radiation from the boiler have been laid down. The engineer uses his judgment in this matter; and judgment can only be obtained by experience. Whenever a doubt exists, failure can be avoided by using pipe that is a size larger than the doubtful size. A vertical service of a given length will work well with pipe of one, and sometimes two, sizes less than would be required for a horizontal service. Again, a horizontal service which has, say, 15 ft. of vertical pipe leading to it will probably work well with a less size of pipe than a horizontal service beneath or on the ground floor. Tables to meet

all conditions might not be impossible, but the construction of such tables is a greater task than any person has yet attempted, and even if done might not meet every case (perhaps not half), as no two jobs are alike

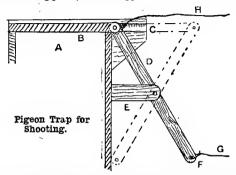
Table: Sizes of mains, one-pipe system of hot-water heating work, mains running horizontally. These are minimum sizes for normal distances.

| | will supply | 80 ft. | of radiating | surface. |
|--------|-------------|--------------------|--------------|----------|
| l⅓ in. | ,, | 150 ft. | ** | " |
| 2 in. | ,, | 300 ft. 500 ft. | 22 | ** |
| 21 in. | ** . | 800 It. | ** | " |

Table: Sizes of mains, one-pipe low-pressure system of steam heating work, mains running horizontally. Minimum sizes for normal distances.

The mains and branches unless thickly covered count as radiating surface; even then the pipes lose some heat.

Pigeon Trap for Shooting.—A pigeon trap for shooting purposes might he made as shown by the accompanying sketch. A is the opening of the trap, which is closed by a sliding door B working in grooves C. To the back of the door a lever D is connected by a pin. The centre of this lever is attached to the body of the trap by a wooden jaw E which acts as a fulcrum. The lower end of the lever at F is connected by a cord G to the releasing point, and the upper end is also connected



to the same point by a cord H attached to the top of the lever by a small staple. When H is pulled, the lid slides back to the dotted line and the trap opens, and when G is pulled the reverse action takes place and the trap is closed.

Reducing Flooring and Matching to 100 ft. Square.

—A simple method of reducing the number of running feet of any width batten or board to a square of 100 ft. super. is to reduce the single foot of the beard to inches and divide into the number of inches contained in a square superficial of flooring, etc. For example: 144 in. to a square foot multiplied by 100 ft. in a square gives 14,400. Taking 7 in. as the width of flooring, 1 ft. run contains 84 in.; divide this into 14,400.

 $\begin{array}{r}
84 \\
14400 \\
84 \\
\hline
600 \\
588 \\
120 \\
84 \\
\hline
36
\end{array}$ = say 172 ft. run.

Again, take 4½ in. matching: 1ft. of this contains 54 in., and, divided as before, gives 266 ft. The average width of a 7-in. board is 6½ in.; ½ in. must therefore be allowed for the deficiency in width and waste in cutting. The appended table will be found useful:

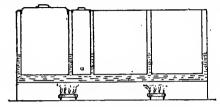
BUNNING FEET CONTAINED IN A SQUARE.

| In. | | Ft. run. | In. | | Ft. run. | | | |
|----------------|-----|-----------------|----------------|-----|-------------|--|--|--|
| 12 | | 100 | 61 | ••• | 185 | | | |
| 11 | | 109 | 6 | *** | 200 | | | |
| 10 | ••• | 120 | . 5 <u>1</u> | | 21 8 | | | |
| 9 | ••• | 13 1 | 5 | ••• | 240 | | | |
| 8 | *** | 150 | $4\frac{1}{2}$ | | 267 | | | |
| $7\frac{1}{2}$ | ••• | 160 | 4 | *** | 300 | | | |
| 7 | | 172 | | | | | | |

White Paint for Cance Yawl.—Pure zinc white or lithopone has been proved to be best suited for any kind of sea craft, as it resists the action of the salt water much better than white-lead paints. The zinc white or lithopone should be ground to a paste paint with pale boiled linseed oil, and thinned down to the required consistency with colourless copal varnish and a little turpentine. If required, the work may be primed with white-lead paint and finished with zinc white. A finer finish may be given, and the work rendered even more durable, by applying over the above two coats of hard colourless copal varnish. This method will give a clear enamel-like surface that will not be affected by salt water. salt water

Bonbon Crackers.—In making crackers for bonbons the following method may be adopted. Two strips of thin cardboard about 4 in. long snd 1 in. wide are cut. For a distance of about 1 in. at one end of each strip a little glue is applied, and when this becomes tacky a few grains of coarse sand are sprinkled on it. When the glue is properly set, a very small piece of fulminate of silver or of mercury is placed on the sand on one of the strips: the other strip is reversed, and the end having the sand on it is laid on the first strip, the fulminate being between the two layers of sand, then a strip of tissue paper is pasted round the two ends, thus binding them together. When the two ends are pulled, the friction of the two layers of sand explodes the fulminate.

Hot Cupboard for Cooked Foods.—An apparatus similar to the sketch will be suitable for keeping cooked food hot. It consists of a large tin tank with the various receptacles or vessels fixed so that their lower parts rest in hot water. Two small blue-flame gas



Hot Cupboard for Cooked Foods.

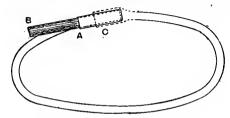
rings will furnish the heat. This plan gives a supply of hot water, but otherwise the water might be confined to a small well, which, with one gas ring, would give sufficient steam to fill the spaces around the vessels and keep them hot.

sufficient steam to fill the spaces around the vessels and keep them hot.

Celluloid Manufacture.—In manufacturing celluloid, known also as parkesine and xylonite, there are two stages: (1) the produc ion of the so-called pyroxyline; (2) the treatment of this composition with solvents in order to make it plastic, and to give other desired qualities. A quantity of cellulose or woody fibre, such as disintegrated cotton waste, paper, etc., is treated in a "converter" with a mixture of one part of nitric acid and from four to five parts of sulphuric acid, mixed in a separate earthenware jar and kept as cool as possible. This mixture is pumped into the converter, and the fibrous matter is placed in a hopper above the converter, and gradually fed into the acid. This occupies from ten to twenty minutes, and the substances are converted into nitro-cellulose. This then falls through an opening in the bottom of the converter, and is caught in a box with a false perforated bottom made of wire gauze, placed about six inches from the real bottom. On this the wet mass remains for one hour to allow the acids to drain away, the material being then placed in a cylinder, and the excess of acid squeezed out by hydraulic pressure. The result is a hard cylinder of pyroxyline, containing from five to twenty per cent. of acid mixture, in which state it is stored for future use. It is then again pressed in a cylinder, and broken up as before. This is now dissolved with wood napthaligal. The first three quarts of the distillation are taken for use; the remainder is caught in a separate vessel so long as any spirit comes over; behind in the still is the chloride of lime dissolved in water and containing some tarry matter. It is now put into an open vessel, heated from beneath to evaporate the water and fuse the chloride of lime for future use. This is applied to the pyroxyline in such proportions as to make a pasty mass: but if used alone, the resulting celluloid would soon become hard and brittle. To avoid

this, a certain quantity of oil is added to the mass and kneaded in a mixing machine, the proportion of oil varying with the desired degree of toughness. To make it resemble ivory, the celluloid is made without any colouring matter, and kept as clean as possible; when in a dough-like state it is rolled into sheets ration in thickness. Meantime, another celluloid is prepared containing carbonate of strontia or strontium (an earth with a metallic base) in the proportion of 1 part to about 200 parts of pyroxyline, which is also rolled into sheets, placed one over another, and re-rolled to fix them together. A good plan is to lay a transparent sheet on top of an opaque one and roll together, then take the roll, twist it, and pass through heated rollers and roll to a slab for cutting into strips or into blocks for turning. This material can be turned, carved, engraved, and moulded; the drawbacks are that it is very inflammable, and, unless particularly well seasoned, shrinks It keeps its colour, and can be cleaned with soap and water. It may be used for all purposes for which ivory is used, and is of course much cheaper. There are also other processes.

Shortening Inner Tubes of Cycle Tyres.—For shortening the inner tubes of cycle tyres so that they can be used on smaller rims, the inner tubes should be placed on the cycle rim they are required to fit, and a piece cut out where the tube is joined, leaving 2 in. to overlap. The inside of one end and the outside of the other must be cleaned with benzoline. To rejoin the air tube, turn one end inside out as at A in the diagram, and push a piece of broom handle B, or anything round and of suitable size, inside the piece turned back as shown. The other end



Shortening Inner Tubes of Cycle Tyres.

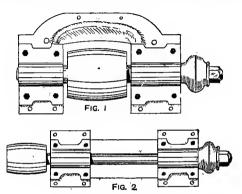
C is drawn over the air tube to within 2 in. of the end A, as shown by the dotted line. After the ends have been cleaned with benzoline, coat with the solution, and turn the end A back over the end C. Allow to dry, draw out the mandril, pull the air tube out straight, and the joint is complete. When putting the two ends on the mandril, care must be taken that the tube is not twisted

Materials for Watch Jobbing.—Below is a list of materials required by a jobbing watchmaker who wishes to do his own turning, jewelling, etc., and who is some distance from a trade supply house. Watch glasses, lunettes in quarters, 4 to 24, crystals in eighths, 3 to 24, hunters in eighths, 2 to 22, in heights of 6 to 8. Mainsprings, from 1 mm. to 4 mm. in width, sized according to the gauge in use, and in assorted strengths. Keys 1 to 10, no gross of loose endstones, one gross of set endstones. the gauge in use, and in assorted strengths. Keys 1 to 10, one gross of loose endstones, one gross of set endstones, one gross of solven holes and one gross of unset jewel holes, two dozen Geneva set-squares, three dozen small clicks, three dozen side clicks, three dozen steel Geneva ratchets, three dozen brass English ratchets, and half a gross of flatted gannet pins for rollers. Also some bouchons, rough balance staffs, rough hairspring studs and cylinders, one gross of Geneva hairsprings, cards of assorted English and Geneva hands (one dozen pairs on a card), plenty of unfinished screws, and if possible a box of Progress finished screws, hands, keys, drum clock winders, set hand buttons, feet, etc., will be required. Most other things can be made in an emergency, and the above would do very well for a small stock.

Ivory White Paint.—To make ivory white paint of a flat or eggshell finish, beat well together in a paste form 14 lb. of genuine white-lead and 1 lb. of patent driers, then add about \(\frac{1}{2} \) oz. of yellow ochre and \(\frac{1}{2} \) oz. of venetian red, both paste paints. Stir the paste thoroughly until the colour is intimately mixed, and if of the required shade, thin the paint down with 2 parts of turpentine and 1 part of holled oil. If the colour is not deep enough, add paste paint in the above proprtions. For a glossy paint, use the same proportions of paint, and thin down to the required consistency with 3 parts of boiled oil, 1 part of varnish, and 1 part of turpentine. turpentine.

Repairing Torn Harness Bridgeband,—This is frequently torn across in some part of the body; to repair, shave the ends thin, and join the break with a few stitches. New pieces must be put on both sides, and, when necessary, another in the centre. Let the top lay be 1 in. longer at each end than the lower lay, and shave it thin at both ends. Next make four or five rows of strong stitches from end to end, but never stitch the patches across; also make two or three stitches at the centre in the points, keeping to a uniform thickness as much as possible. The same remark applies to the backband, bellyband, or crupper of the lesding gear when they are torn. In case of chapes like those for bridgeband tugs, use strong leather, shave the ends, and let the upper side be a little longer than the lower; also thin the part put in a little.

Circular Saw for Cutting Hardwood.—The best plan for mounting a light saw, no matter what the motive power, is to purchase a fitted-up bed-plate and mandrel, which can be placed in any position, keeps in perfect truth, and can also be adapted to several other uses (see Figs. 1 and 2). The diameter of the saw should not be less than 12 in. if it is to be used for 3-in. stuff. The centre hole must, of course, fit the mandrel head. A 1-in. hole is the size usual for a saw 12 in. in diameter. The saw may be thin at the centre and thick at the edges, to run without "set"; or, if it is a plate saw, the gauge should be about No. 15. A tooth of medium rake, spaced about \$\frac{1}{2}\$ in. point to point, will be suitable. The saw will cut soft wood readily, but not, of course, so



Saw Mandrels and Bed-plates.

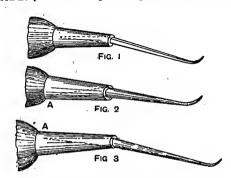
effectively as one specially designed for operating in soft wood only. The saw should run at not less than 700 revolutions a minute. It will absorb, on the average, about horse-power. Workers are strongly advised not to run the saw in the lathe, either direct upon a maudrel or upon a separate spindle mounted between the lathe centres.

crupon a separate spindle mounted between the lathe centres.

Analysis of Mortar,—Below is described the method of determining by analysis the percentage of calcium hydrate, carbonate of lime, and slaked lime in a sample of mortar. Recently burnt lime consists of calcium oxide or lime (CaO) principally; when this lime is slaked it forms calcium oxide will have escaped hydration, nence calcium oxide does not exist in mortar. Calcium hydrate is often termed hydrated calcium oxide; that is, it consists of calcium oxide with one molecule of water attached, and the formula may be written CaO.H.O. but this does not alter the statement already made that there is no calcium oxide in slaked lime. The constituents to be determined are calcium hydrate and calcium carbonate. Calcium hydrate is soluble in water and gives a pink colour with phenol phthalein, while calcium carbonate is insoluble and does not affect that reagent. In order to determine the former, take 10 grams of the material in its present condition, add recently boiled distilled water, wash into a 500 c.c. flask, make up to 500 c.c. and shake well. Now pipette into a beaker 20 c.c. of the turbid liquid, add phenol phthalein and titrate with a normal solution of hydrochloric acid until the pink colour disappears. Read off the number of c.c. so dacid required and multiply by '37 × 25 × 10; this will give the percentage of calcium hydrate. In order to determine the total lime, shake the solution in the flask and again take out 20 c.c., add 50 c.c. of the normal solution of hydrochloric acid, boil, add litmus solution and titrate back with a normal splution of caustic soda. Calculate the total lime thus: 50 c.cs. of

soda used × 028 × 25 × 1). The carbonate of lime may be calculated as follows: The calcum hydrate found in the first estimation is calculated as lime by multiplying by the factor 7568, the product is deducted from the total lime, and the remaining figures then represent lime existing as carbonate; this is calculated into carbonate of lime by multiplying by the factor 1786. The total lime in a mortar is usually estimated by weighing 10 grams, adding excess of hydrochloric acid, precipitating with ammonia and ammonium oxalate, and drying and igniting the precipitated calcium oxalate; this yields pure lime (CaO) present both as hydrate and as carbonate. The carbonate of lime is usually estimated by weighing a portion of the mortar, placing in a carbonic acid apparatus, adding hydrochloric acid, and either weighing the loss after escape of carbonic acid or measuring the arbonic acid evolved. This is calculated into carbonate of lime by multiplying by 10. The lime or mortar must not be dried before these determinations.

Fixing Handles on Shoemakers' Awls.—It is, essential that shoemakers' awis should be put into their handles in the right manuer, otherwise they will break very readily. Take the handle in the left handle and with a fine peg-awl or bradawl bore straight up the centre a hole not quite so large as the butt end of the awl that is to be placed in the handle. The hole must be perfectly straight, or such awls as peg-awls and stabbing awls will protrude in a crooked direction, and while in work no power can be placed upon them, as the power,



Fixing Handles on Shoemakers' Awls.

coming from the top of the handle by pressure from the hand, is not in line with the awl. Holding the centre of the awl between a pair of pincers in the right hand and the handle in the left, press the awl into the handle till just tight; then, with a lapiron on the knee, gently tap the top of the handle thereon while holding the awl firmly in the pincers till the awl is quite tight. Closing, sewing, and stitching awls, which are all hent, need to be placed in the handles very carefully. Fig. I shows the correct method of putting in these awls, whilst two ways of putting them in incorrectly are shown at A (figs. 2 and 3).

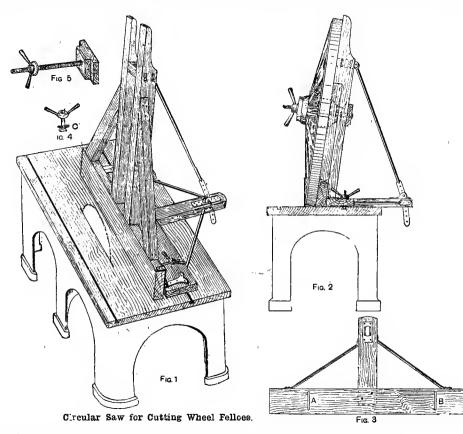
Carved Appearance in Burnished Gold Letters—All shading that comes between the gold and the glass must be put ou before the gilding. Gold is shaded with yellow ochre and burnt sienna, and the colour would naturally be less hrilliant than the burnished gold. Incised ornament that is sometimes done on hurnished gold letters is obtained by the ornament being burnt out with hydrofluoric acid, which dulls the glass, and as the glass is eaten away it has the appearance of being carved out. Some makers supply bevelled gold letters that are fixed on the back of the glass, and which have a burnished edge.

Modelling Wax.—It is cheaper and more satisfactory to buy modelling wax than to make it, as first attempts generally result in a sticky mass unpleasant to handle. However, here are a few receipts. (1) Ilb. of beeswax, 20z. of Burgundy pitch, and loz. of lard. melted together over a slow fire, stirring well all the time; add yellow ochre in powder to give a colonr. (2) Ilb. of beeswax, 1lb. of lard, and I gill of linseed oil, melted at a slow heat; add about 1lb. of flour or sifted whiting, and knead well. If the mass is too sticky, add more flour or whiting. () Ilb. of beeswax, 1lb. of suet, and I gill of white turpentine; add whiting, as for (2). Any of the above mixtures may be tinted by the addition of powdered colours, as yellow ochre, Paris green, red-lead, vermillon, etc.

Circular Saw for Cutting Wheel Felloes.—The accompanying sketches show a method of arranging a circular saw for cutting round the insides of wheel felloes. The details may be modified to suit the particular saw-bench in use. The arrangement comprises two distinct pieces of framework, hingsed together, and adjustable to each other at any desired angle by a stay-rod; see Figs. I and 2. The whole of the apparatus can be brought closer to, or taken farther from, the saw by means of the slots A and B in Fig. 3 (which is a plau of the lower frame), and can be fixed at any desired distance to suit the thickness of the felloe. At the same time, the whole of the framework may be slid slong the saw-bench in a direction parallel to the saw whenever required. To effect these two motions, a special form of bolt as Fig. 4 is necessary, The frame itself is gripped between the collar C and the fly nut. The collar C is not a loose washer, but is forged on the holt. The position of this bolt and collar in relation to the framework and to the saw-bench may be seen in Fig. 2. The varying pro-

ment necessary for the thickness of the felloe would then be made by clots in the metal hinges.

Pinning on Roofing Tiles.—In Kent and Sussex local made plain roofing tiles are each provided with two holes for hanging. These holes are suitable for either iron or wood pins, but wood pins have now become almost obsolete. The wood pins are always made from carpenters' refuse when available, such as odds and ends of joists and rafters. The splitting may be done with a hand-bill, a carpenter's axe, or with a mash hammer and boaster. The length of the pins may he from 2 in. to 2½ in., and the girth is regulated to snit the sizes of the holes, which vary considerably, according to the firing the tiles have had. The pinning is done before the tiles are taken on to the roof, one hole only being used, right-hand and left-hand alternately, so that, in the process of hanging, a ralter may be quickly selected. In pinning, the pinner places one hand over the hole to be pinned, to counteract



jection of the hubs is accommodated by making the two main vertical posts extra wide. The centre bolt shown at Fig. 5 is not attached to the framework in any way, but may be quickly raised or lowered to suit any height of wheel. The bolt does not support the wheel; the wheel should, in fact, rest solid on the bench the whole time. In commencing to saw, the whole framework should be drawn back and the wheel placed in position, and by means of the centre bolt screwed down rigidly in place. The saw is then put in motion, and the framework advanced to start the cut. When the centre bolt is slackened so as to permit of the wheel rotating to complete the cut round the circumference. The appliance will undoubtedly effect a great saving of labour, but its use is open to considerable danger. The utmost precaution should be taken to see that everything is properly fixed before starting: also be especially careful of the unfenced saw, which is very dangerous when approached from the top. If the saw-bench is not provided with a dovetailed groove, threaded studs should be inserted in suitable positions, and long slots substituted for cross slots in the lower framework. Adjust.

the concussion arising from driving the pin home. He can also thus feel when the pin is flush. Great care has to be taken both in driving the pins and in regulating their size; otherwise many tiles will be broken. When pinned, the tiles are hung one upon another in bunches of about a dozen, and are sometimes taken to the roof so clustered, upon the arm, or they may be hauled on to a scaffold in a basket. A hod is not suitable.

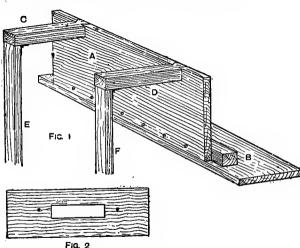
Frosting Aluminian.—To frost bright aluminium, put it into a strong solution of caustic soda or potash, and allow it to remain till covered all over with fine bubbles, then well wash and dip in a solution of nitric acid of ordinary strength. Several applications may be required before the article will be sufficiently dull. Finally, rinse and dry in warm sawdust. The best method, however, is to have the surface sand-blasted. This is done by machinery, by projecting in a sharp, fine stream a fine preparation of special sand having a sharp cutting edge, which slightly indents the surface of the metal and leaves an excellent frosted appearance. This method is usually adopted to frost medals in silver, copper, bronze, or any metal.

Paint for Engine.—The paint used for railway engines may be made by adding crimson lake or deep madder red to ordinary middle shade Indian red. The exact quautities of each cannot be given, as colours vary in strength or density. By procuring about 71b. of Indian red and 11b. of the lake or madder red, and adding the latter to the former, the shade may easily be produced. The colours should be obtained ground in turpentine, and mixed to working consistency with a parts of turpentine and 1 part of gold-size, applied in the usual manner, rubbed down, and varnished with hard copal varnish.

Timing Stand for English Clocks.—Fig. 1 shows a useful timing stand suitable for the movement of grandfather clocks; it can be fixed with two G cramps or two shutter screws to a shelf, or to the end of a bench, the latter being most convenient, as then the action of the pendulum rod can be seen in the fork of the crutch, and adjusted if necessary. When not in use, the stand can be taken to pieces in two minutes by a few taps with a hammer. The side A may be of \$\frac{1}{2}\$-in, or 1-in, deal, 1ft \$\frac{4}{2}\$-in, long and 6 in, wide, and the piece B is 1ft \$\frac{6}{2}\$-in, long, 2 in, wide, and 1\frac{1}{2}\$-in, thick; these pieces are screwed together as shown. The dimensions stated are for a bench 2ft. \$\frac{7}{2}\$-in, high, but for a lower bench than this the piece A must be made wider so that the pendulum may swing clear of the floor. Next cut out the pieces of and D, each 7 in, long, 1\frac{1}{2}\$-in, wide, and 1\frac{1}{2}\$-in, thick. Set out the dovetails, and cut down with a fine saw. The

Then take off the template. At this stage it will be well to study the setting properties of the pure cement, so as to be able to judge the quantity of moulding that can be run in the day's work. It would be well for an inexperienced hand to start with the fine cost early in the day, as this would give him every chance to watch his work, which, if engaged otherwise, he may do by paying periodical visits. A little more pure cement than can be applied in one coat having been mixed, the surplus is left on the mortar board, and when this coat has gone in or partly set, make up some more cement and mix the surplus through it; which being half set and softened again, will render the cement as gauged quite fatty. Continue adding surplus to fresh gauge until the moulding is finally run off, when it, should be saharp and the arrises so smooth that plaster moulds could be taken from it. The same method may be adapted for inside work.

Fastening for Field Gate.—A substantial latch for a field gate is shown in side elevation by Fig. 1; A is a wrought-iron bar, \$in. diameter, forged to a knob at the top so as to be convenient for handling, and welded at the bottom to a bar B of soft steel \$\frac{1}{2}\$ in. by \$\frac{1}{2}\$ in. in section. This is then tempered so that when its lower end is acrewed to the slamming stile the top springs



Timing Stand for English Clocks.

Fig. 2

Fastening for Field Gate,

dovetails are each 2\frac{1}{2}\text{in. from the end of the piece A. Put the dovetailed ends of C and D in place, and support the other ends at the same height with anything suitable. Then fix the base in place with clamps or screws, and set it level with a spirit-level. The distance from its lower surface to the floor will give the length of the legs E and F, which are \$1\frac{1}{2}\text{in. wide by \$1\frac{1}{2}\text{in. thick.}\$ At the bottom end of each drive in an iron pin \$\frac{1}{2}\text{in. thick.}\$ and allow \$\frac{1}{2}\text{in.}\$ to project to slip into holes in the floor. Now fix the pieces C and D to E and F with back-flap hinges, as shown, and make the seat-board (Fig. 2) Ift. long, \$4\frac{1}{2}\text{in. wide, and \$\frac{1}{2}\text{in.}\$ thick, and cut a hole in it \$4\frac{1}{2}\text{in. long by \$1\frac{1}{2}\text{in.}\$ to me the other, it can be adjusted to suit any clock by turning either the wide or the narrow part towards the clock dial. Finally, make two holes for tying up the ends of the gut lines as shown by the dots in Fig. 2.

Finishing Cement Cornices.—It is assumed that some cornices to fill in an angle are to be executed in Portland cement, and in that case, whether inside or out, they can be finished quite smooth and sharp, so as not to require any trowelling whatever. For an outside cornice, having got the mould ready, cut out a sheetirou template to the same design, only a little smaller, so as to show about in. all round. This is nailed into the mould. The running laths being in positiou and all ready, make up a gauging of cement and coarse sand, 2 to 1. When this is mixed and softened, apply a thick coat to the wall, and press bits of broken brick, etc., well into it; then coat again, and soon until the gauging is brought out to the template, and rough enough to form a good key for the subsequent coat of fine cement.

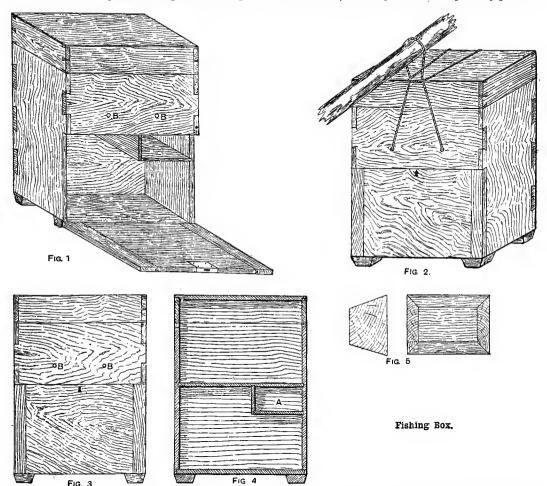
outwards. It is euclosed in the collar C, which not only prevents it being pulled off or broken, but materially strengtheus the gate. This collar may be of l-in. by ½-in. wrought-iron, and it is shown in plan in Fig. 2. Fig. 3 is a plan of the latch or hook D (Fig. 1) into which the spring fits when the gate is shut; it is drawn off to a point, as shown by the dotted lines, and driven into the beating post. To lock the gate use a chain and padlock.

Soundboard of Piano.—The soundboard of a piano as usually constructed is built up of thin Swiss pine strengthened on one side by transverse bars which are glued on; these bars are planed up slightly camber in their length, thus giving the board a slightly arched appearance somewhat resembling the front or back of a violin. The soundboard is placed immediately hehind the wires, extending from the wrest-plank (in which the tuning pegs are inserted) downwards to the iron plate on which the wires are hitched. The soundboard is suspended by screws at the sides; on one side a portion fits into a rebate on the crescent-shaped piece of wood on which the trelle end wires are hitched. If the instrument is of iron frame type, the soundboard may be of larger size; in any case there are no pegs, such as are found in instruments of the violin class; and the support given by the hars is generally sufficient. If these become loose by reason of tha glue giving way, the instrument acquires a tubby or wooden tone; in that case the necessary repairs should be done by an experienced mau.

Fishing Box.—A fishing box made of wood is shown open in Fig. 1 and closed in Fig. 2. It is the custom with most anglers to carry their boxes on their backs, and for this purpose they have either a stout cord (see Fig. 2) or leather straps. A box of the following dimensions is of a convenient form to be used as a seat. Height without feet, 15 in.; width, 11 in.; and depth, 8 in. 1t is preferable for lightness to uss \(\frac{1}{2} \) in. pine in the construction of the box. The sides are dovetailed together, and the top and bottom are rebated as shown in Figs. 1 and 4. The box 1s divided into two compartments, the top being for food and the bottom for bait, etc. On the bottom there is another division A (Fig. 4) for a tackle case, and further divisions can be made if required according to the taste of the maker. To keep the front flap from twisting and

is screwed down through the end of the spindle, and hears on the top edge of the cutter. It will therefore be seen that the face of the cutting iron is on a direct radius of the spindle end; and, such being the case, it will strike the wood dead square. Also, as there is, from this reason, no "angle of entrance" like that which occurs in irons more tangentially placed, practically the whole of the French spindle work is effected by abrasive or scraping action rather than by clean cutting.

Gelatining Showcards.—When gelatining showcards there is always the risk of prints sticking to the glass, and this may arise from several causes; for instance, the solution of gelatine may he too thick, or the glass may not be clean, or it may have been imperfectly polished



warping, it should be clamped as shown at Fig 1, and when closed this flap is secured by a lock; see also Figs. 2 and 3. To prevent the bottom getting wet and consequently becoming rotten, four feet, shown separately in Fig. 5, should be fixed. Four holes, \(\frac{1}{2}\) in diameter, are required for the straps, two at the front as shown at B (Figs. 1 and 3), and two at the back in a corresponding position. The cords shown in Fig. 2 are in the position they occupy while the box is being carried.

French Spindle Woodworking Machine.—Any wood shaping machine or spindle machine in which a loose top spindle end is used may be converted into a French spindle machine. The French spindle identical with other spindle machines as far as the general design of the machine goes, but instead of the ordinary cutter head—the dovetailed grooved block—a modified type of loose spindle end is used. A slot is pierced through the spindle end, and in this the cutter is placed. The cutter is fixed by means of a stud, which

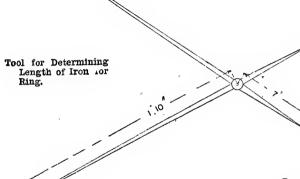
with French chalk, Castile soap, or other substance. An easier and a surer method is to coat the print with the gelatine, either with a brush or roller, and allow it to dry thoroughly. Then soak the print in water, in which a few grains of alum have been dissolved, and, having blotted off the surplus water, place the print on the glass and rub it into perfect contact, and allow it to dry naturally in a warm room, but away from any source of intense heat. The high glaze given by this process depends entirely on the surface of the glass or other plate. The film of gelatine need only be thin. Hence the solution must be very thin, but it must be used warm, as when it is cold or partly cold it cannot be worked. Therefore a hot-water arrangement must be provided by means of which the gelatine is kept at an even temperature. As soon as the gelatine falls below a certain temperature troublesome little thick pieces form; also when using a brush care must be taken not to allow it to become chilled. Finally, much better results can be obtained by the simpler process of varnishing.

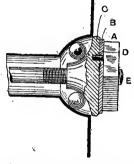
Smell from Gas Fire.—When a gas fire with a japanned cast-iron frame is first used, a smell of burnt japan is always noticed, the fiue being powerless to prevent this. The only thing to be done is to make the stove as hot as possible for a short time, so that all the japan that can be burned off is disposed of at once and for good. In any case, the odour usually disappears after about, say, six hours' use. If the odour is not of this kind, then the products of combustion must be coming into the room; and if the pipe from the stove terminates in the chimney (in the customary way), the chimney itself is probably at fault, suffering perhaps from downblow, or some defect that prevents a normal up-draught. Gas fires are quite frequently used in rooms the chimneys of which will not admit of a coal fire being lighted, but the gas fire requires a proper up-draught in lighted, but the gas fire requires a proper up-draught in the chimney just as much as a coal fire.

Determining Length of Iron for Ring.—One rule for finding the length of iron required for a ring is the following. Take 3\(\frac{3}{2}\) times the diameter, plus 4 times the thickness, and add also the thickness of iron for welding. Thus, supposing the ring is 7 in, inside and to be of \(\frac{1}{2}\)-in. iron, then 3\(\frac{1}{2}\) times 7 in. are 22 in. \(\frac{1}{2}\) 4 times \(\frac{1}{2}\) in. = 1 in. \(\frac{1}{2}\) and once the thickness of iron for welding is \(\frac{1}{2}\) in. Then the length of iron to cut off is

sulphate PbSO₄; but it will contain barytes, china clay, or terra-cotta if the material is adulterated. Boil the residue with strong hydrochloric acid, and then filter it whilst hot; the residue will be the adulterant. For testing Brunswick greens, boil a small quantity of the green with strong hydrochloric acid for about eight minutes, then filter whilst hot, and wash well with boiling water. The residue consists of barytes and Prussian blue. It is next subjected to a considerable heat until the blue is entirely decomposed. It is then treated with a mixture of hydrochloric and nitric acids and boiled well, which will remove the oxide of iron. It is then well washed, filtered, and weighed, the residue being barytes. The easiest method of determining the strength and purity of pigments is to add, say, 5 per cent. of the colour to paste white-lead; also treat a sample of known purity in a similar manner, and place the tints side by side. That possessing the deeper shade is evidently the stronger and better colour. A qualitative analysis or test is not recommended unless the worker has had some experience with chemicals. The method last described would meet any ordinary requirements.

Preventing Cycle Pedal Bearings Working Tight.—The illustration shows a device for preventing the cone of a cycle pedal screwing up on the spindle, and hindering the pedal from revolving freely. After removing the locking nut A, and adjusting the bearings, drill a small hole through the D-washer B, and into the cone C, to a depth equal to the thickness of the washer. Into this hole insert a piece of tough wire D, fitting it tightly, and then cut off the projecting end of the wire, to allow the locking nut A to be screwed up tight on the spindle E, and to prevent the wire dropping out of the reventing Cycle Pedal Bearings Working Tight.





Preventing Cycle Pedal Bearings Working Tight.

hole. The position of the wire is shown in the illustra-tion. By this means can be secured a perfectly rigid adjustment of the pedal bearings.

lft. Ili in. This is correct for thin iron only; for when welding it is found that the thinner the iron the more it requires, in proportion, for jumping up to allow for the waste. Thus, if the same rule were carried out for rings of a larger sized iron, say 21n. by \$\frac{1}{2}\$in., either the weld would be much thicker than the original iron and would look very clumsy, or its diameter would be larger than required. The tool here illustrated renders unnecessary any calculation for the length of iron required to make a ring. The two legs bave a riveted joint, and if the short end is opened I in., the long eud opens \$\frac{3}{2}\$in, and so on. Thus in the case of a 7-in ring made of iron \$\frac{1}{2}\$ in. thick, the smith would simply open the short end \$\frac{1}{2}\$ in. and put a rule across the long end, which would read about \$23\frac{1}{2}\$ in. Then allowing \$\frac{1}{2}\$ in. for welding, etc., the total length required would be \$24\frac{1}{2}\$ in. Determining Capacity of Milk Can.—In calculating the capacity of a milk can which is 3ft high, 20in. in diameter at the base, and 12 in. in diameter at the top, it must be remembered that such a can is a right construction. To determine the cubic capacity of such a frustum, it is necessary first to find the cubic capacity of a complete cone containing the given frustum, and then determine the cubic capacity of the small cone which is formed on the top of the frustum by producing the slant sides of the frustum until they meet at the apex of the cone. Then the capacity of the small cone is subtracted from that of the large cone, and the difference would be the capacity of the frustum. For a frustum of the sizes indicated above, proceed as follows. To find the area of the base of the frustum, multiply the diameter by the diameter, then multiply by 7834, the two first places of decimals being sufficient for ordinary work. Thus, 20 × 20 × 78 = 312. Multiply the area by one-third the height of the complete cone containing the frustum, or one-third of 90in. Then 30 × 312 = 9360 cmb. in. In the complete cone. Find the cubic capacity of the small cone by the same method. Thus 12 × 12 × 78 = 11232, and the height of the small cone is 54 in., so that one-third is 18 in., and 112 32 × 18 = 2021 76. Subtracting this, 9360-2021 76 = 7338 24 cmb. in. in frustum of cone. For the contents in gallons, divide the last number by 277 25, or 7338 24 + 277 25 = 2646 gal. (about). A more direct method of solving the same question is by means of the following formula: Volume in cub. ft. of frustum of cone = H × 31416 × (R* + r* + Rr*), where Testing Pigments.—Below is information on testing oxide of iron colour, Brunswick green, yellow and orange chromes, etc., for purity and material. Now red oxide is a very difficult pigment to test with acids, etc., unless its origin is known, as its solubility varies according to its composition and preparation. The simplest method is to weigh out a given quantity into a beaker, and add a mixture of hydrochloric and nitric acids, and heat, until completely decomposed, over a Bunsen burner. Theu evaporate the solution to dryness, and treat the residue with dilute hydrochloric acid, then wash well with water, filter, and finally dry. This process will leave the adulterant, barytes, silica, etc. For lemon and orange chromes, place a small quantity of the chrome in a test tube, add about three times its volume of strong sulphuric acid, and heat until completely decomposed; then allow it to cool, add an equal volume of water and a little alcohol, filter, and wash well. The residue, if the pigment is pure, will be lead

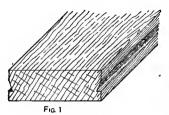
 ${f H}={
m height}$ of frustum, ${f R}={
m radius}$ of large end, and $r={
m radius}$ of small end—all in feet. This formula works out at 26 65 gal., which is the correct answer.

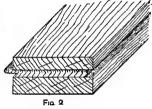
Emery.—Emery is a well-known compound, which sharpens tools, polishes plate glass or leuses, bright steel goods, and almost anything else that comes in its way. As a polishing agent, it is, of course, no novelty, for the ancient Greeks used and valued it and called it smyris, from which term most European nations have derived their name for the material. Naxos, one of the isles of the Grecian Archipelago, was for long the sole source of emery, where it was worked by a lessee under contract with the Government of Greece. Other sources have been found. In Asia Minor there are abounding deposits of emery. The Naxos island lacks good harbourage, and the mineral has to be shipped from Syra and Smyrna. The distribution of emery in nature is peculiar. It is found on mountain tops in the vicinity of Ephesus and in the valleys. It exists in nuggets, great and small, loosely embedded in reddish soil, and also in the form of nodules in crystalline limestone or marble. Pieces weighing 30 tons to 40 tons are found, and masses very much smaller, which are worked by simple exposure of the surface, or by means of shafts and galleries. The blocks are broken by sledge hammers, but sometimes they must first be roasted and cooled to make disintegration possible. The pieces are then carefully handpicked and sent from Asia Minor by camel and donkey to the railroad, and thence to Smyrna, to be carried as ballast in the sailing ships light-loaded with cargoes of liquorice root. Emery contains 70 per cent. of lumina and from 8 to 25 per cent. of oxide of iron. The native alumina, Al-O., is corundum or adamantine spar, a substance second only to the diamond in hardness. Corundum is a term applied in its wide sense to embrace adamantine spar, sapphire, and emery. In emery the alumina does not crystallise into the rhombohedral shapes typical of its other forms. Again, emery presents the dull or opaque variety. When blue and transparent corundum is sapphire, when red it is ruby

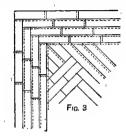
destined for the most delicate purposes. The makers of optical glasses are most exacting in their requirements. Emery is a substance of much greater importance than, from its mere bulk of production, might appear. Some 10,000 tons is an estimate of the output imported at British ports, Hamburg and Rotterdam. The specific gravity may be taken at 3.75 for Naxos and 3.98 for Samos qualities. In emery it is not considered that predominence of alumina is so important as an indication of quality as is the state of mechanical aggregation with its other components.

Firework Crackers.—The mixtures used in crackers and other fireworks are either ordinary gunpowder or similar mixtures. The materials are very tightly compressed in a small space; the same mixtures ignited in the open air would simply go off with a "puff." Ordinary crackers are filled with fine gunpowder, and then tightly tied in a zigzag form. For squibs, the composition is: Fine gunpowder 16 oz., saltpetre 12 oz., charcoal 1 oz., and steel filings 1 oz., the end of the squib being composed of gunpowder rammed in tight. The fulminates are the only materials that will explode on ignition; even guncotton and nitroglyceriu will flare away without explosion if a light is applied to a small quantity of them.

Laying Wood-block Flooring.—The mastic (for making which see Series 1., p. 245, and Series 11., pp. 82, 165, and 312) that is used in the laying of wood-block floors is intended principally to assist in the holding down of the blocks, more especially when blocks of the ordinary pattern (Fig. 1) are used. When blocks of the pattern shown in Fig. 2 are used, mastic is not so necessary: at the same time something must be used in order to keep the blocks in position, and whatever is used must be impervious to water. The gas and Stockholm







Laying Wood-block Flooring.

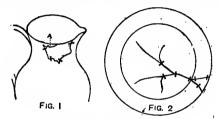
cor oriental ruby, and in other tints the same mineral becomes oriental topaz, amethyst, or emerald. The natural colour of emery varies from bluish-grey to brownish. The rich red chocolate tone of much of the emery of commerce is due to artificial colonring. Other hard substances are employed as adulterants, garnet and iron slag with others. It is noteworthy that French manufacturers employ always the original Naxos emery for preference. The blocks as imported are stamped by ore-crushing batteries, and if needful they are first made hot in the fire. To be useful the emery must be reduced to powder, and of this there are many grades, ranging from grains as large as mustard seed down to the superflour emery, which is deposited last in elutriation with water. The utility of emery rests in its abrasive power, which is tested in a practical way by its action on plate glass. The pulverised emery is rubbed on a weighed plate of glass by means of an agate muller, and by comparing weights at various stages a very direct guide as to the hardness of the material is obtained. Taking blue sapphire as the standard unit of hardness, it is easily possible to denote in terms of figures the merits of any given sample. Pure corundum shows a durability of from 90 to 97 per cent., while that of emery, according to its sources, may vary between 40 and 60 per cent. Hones and wheels of emery present emery in a form suitable for use. They are made by incorporating the powder with some plaster material, and moulding and hardening it. Shellac, paper pulp, artificial stone, or loam and water so baked as to constitute a rough terracotta are all means that are employed. Emery-cake, for loam and water so baked as to constitute a rough terracotta are all means that are employed. Emery-cake, for loam and water so baked as to constitute a rough terracotta are all means that are employed. Emery cake, for loam and water so baked as to constitute a rough terracotta are all means that are employed. Emery cake, for loam and water so baked as to cons

tar mastic answers both the purposes, acting as a damp course and for keeping the block in position. A Portland cement concrete hed 5in. thick, floated over to a level surface with Portland cement and sand (the latter to he washed quite clean) and laid on a hed of broken brick rubbieh, is practically impervious to damp; the concrete should be in parts, small ballast to pass an inch mesh 4 parts, Portland cement 1 part, mixed together dry and turned over three times before adding water.

Planking Model Cutter.—In planking a model cutter, first divide up the half girth of the various sections from the rabbets in the keel, to sheer into portions suitable for the widths of the planking. Procure a strip of pine a little longer than the boat by about lin. wide and it in thick, and also a few pins. Beginning with the sheer or top plank, take the strip, and at about the middle of its length put in a pin, and then fix the strip on the centre frame so that the top edge of the butten or strip is just below the sheer line; then, without peuning the batten in any way (that is, twisting it), tack it to each of the frames, taking no account of whether it comes below or above the sheer line. Now mark all the frames on the staff or strip, and measure from the sheer line to the top edge of the batten at the various stations. Mark approximately the length of plank that will be required on the staff, then remove the same. Put the staff on one of the pieces that are used for planking, measure out on the stations the various distances, and run a batten through the spots thus obtained; this will give an edge of the sheer. Next take the widths that the planks are to be at the stations, and run the batten through; this gives the lower edge. Saw out the plank to the marks, fair the edges, and fix the plank in position; but hefore fixing it is advisable to mark by another plank from this to correspond for the other side. Proceed in the same manner with all the planks. When approaching the bilge, it is advisable to begin planking from the bottom upwards. Ordinary small pins with the points cut off will be found preferable to copper nails.

Hiuminating Fountains.—A small ornamental fountain could not be illuminated in the same way as a large one. In the latter case, a room may be excavated in the base of the fountain and covered with a very thick plate of glass; the entrance to this room may be through a small door at the side of the fountain, and within the room would be several powerful electric searchlights pointing upwards, each one worked by a man. The illumination of the tip of the fountain is produced by a searchlight in the upper window of one of the pavilions. No imitation of this could be produced by gas, because there is no method of removing the hot gives, which would break the glass; but a small electric lamp might be fitted in a water-tight compartment covered with glass in the top of the rockwork, and coloured effects could be obtained by sliding coloured glasses over the colourless piece. But a much better effect could probably be obtained, especially in a darkened room, by the light from a small magic lantern placed on a table about 3 ft. or 4 ft. away, and directed on the fountain. Coloured glasses could be introduced in the usual slot for the slides. in the usual slot for the slides.

Repairing China and Glass,—Cement would effectively repair a jug broken near the top as shown (see Fig. 1), but if rivets are employed distribute them in the manner illustrated. The portion A had best not be tampered with, as it has a very slender hold on the rest of the article, and very little pressure would break it. A good waterproof cement for glass consists of 3 parts listnarge, 3 parts white-lead, and 1 part powdered resin—all by measure. When required for use, mix it into a paste (the proper consistency depends on the purpose for which it is required) with boiled linesed oil. It sets hard in three days. To colour a cement, mix with it colouring matter to be purchased at any oil or colour stores. Winchell's cement is given as a universal cement. Procure ½ oz. of white sugar,



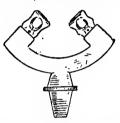
Repairing Broken China.

1½ oz. fine starch, and 2 oz. clear gum arabic. Crush the latter to a powder, then dissolve it in the quantity of water that would be used in laundry operations for the quantity of starch mentioned, and afterwards dissolve both the starch and the sugar in the gum solution. Next place this mixture in some snitable receptacle, and place the latter in a saucepan of boiling water, leaving it thus until the starch becomes clear. The cement will then be ready for use, and should be of about the consistency of tar. If it is to be kept for some time, a few drops of oil of cloves or sassafras will prevent it becoming unfit for use. For boring small holes in glass, a very hard steel drill is used, with turpentine as a lubricant. In repairing the plaque, distribute the rivets as shown in Fig. 2.

Use of Aniline Dyes in Wood Staining.—Aniline dyes can now be applied to many industrial purposes, but it may not be generally known that they can be very advantageously employed in wood staining, although this has been for some time past extensively practised by many manufacturers of furniture. For effectiveness and cheapness they compare very favourably with the ordinary wood stains, and as the dyes are now obtainable in upwards of two hundred different colours, it is probable that they may ultimately become very popular. The process here described of applying the dyes as wood stains will be a simple one to those possessed of a knowledge of woodworking or of graining. Of the various woods American whitewood is the one which most readily lends itself to the process, being freer from knots than most other woods. Next to it would be cottonwood, basswood, or good pine. The wood, whatever it is, must be thoroughly cleaned and smoothed with glasspaper (the straight way of the grain), and brushed off afterwards with No. 1 paper. Then take the dye of the colour decided on and some double size; in water dissolve the dye in a pint bottle, and melt the size in a can or small saucepan, tinting the size with the dye to the shade of colour required. Very pretty effects are obtainable with prey, slate, brown, green, and yellow, all of which have been extensively used in bedroom

furniture by more than one large firm of manufacturers in the Midlands, and have stood the test of time admirably. For the process itself, it is well to point out the necessity, before applying the stain, of stopping up any holes in the wood caused by nails or otherwise. For this purpose use finely crushed whiting, adding some dry colouring matter to match the stain. For example, when applying yellow to satinwood, a small quantity of dry yellow other and crushed whiting should be mixed with water to the consistency of a moderately thick paste. With this stop up all holes or cracks which may exist. Then stain in with a brush, using care not to allow frothing on the wood. No fear need, however, he felt if the stain turns white in working, as it will be found, when dry, to be the proper colour. The next step is to paper down with No. 3 paper, and dust down well with a duster, after which the wood will be ready to receive a coat of some good thin spirit varnish or polish to prevent too great absorption of the stain by the wood. When the wood is thoroughly dry, the operator can put in the grain of the wood with water and a small quantity of beer or sugar, in order to fix the colours. Finally, to fix the water graining, give the work snother coat of some thin spirit varnish or polish, applied lightly, when it will be ready for the finishing coat or French polishing. furniture by more than one large firm of manufacturers

Non-carbonising Acetylene Burner.—A burner bearing this description has been tested with one month's use under varying conditions, with the result that the burner may justly claim to be non-carbonising. It has been left alight, but turned low (the greatest test an acetylene burner can have) for several periods of from four to eight hours, and five burners have all passed through the ordeal satisfactorily. For part of the time the gas was nearly wholly unpurified, and the worst that happened then was that



Non-carbonising Acetylene Burner.

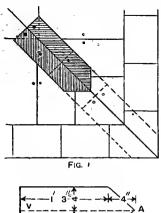
one pin-flame became a little smaller than its comone pin-flame became a little smaller than its companion, but no carbon appeared, nor did any one of the flames lose its brightness and become smoky. A sketch is here given of the burner, and the improvement is in the enamel tips. These resemble ordinary tips, plus a cup or crater, with four holes round each, as shown. The appearance is not objectionable, while the results are distinctly good.

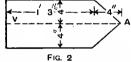
Temperature at which Steam is Decomposed—
The temperature at which steam is decomposed is extremely high. It must be greater than that at which oxygen and hydrogen combine, and therefore higher than that of the oxyhydrogen flame, which is calculated to be 2844°C. Great heat is absorbed in the process. Water may be decomposed at a much lower temperature if passed over heated metals; for example, iron or copper at a red heat will decompose steam, the oxides of the metals being produced. Some metals (for instance, potassium, sodium, calcium, etc.) will decompose water at ordinary temperature, hydrogen being evolved and hydrates formed.

Cork Compound.—For mixing with cork dust in order to produce an elastic mouldable compound, the best thing to use is the adhesive used in the manufacture of linoleum. This substance is boiled linseed oil, which is mixed with driers such as litharge, and air is blown through the mass while it is hot. The oil, in consequence of this treatment, becomes more and more viscous, and when the mass can be drawn into elastic strings, resin, cork dust, and the usual mineral matters are added, and the whole mixed together. Guttapercha softened by heat might be tried, though considerable difficulty would be experienced in mixing the guttapercha with cork dust. Another material that might be employed is a solution of shellac in aumonia. The materials should be heated in a pan under slight pressure, and if only a little ammonia is used a mixture of the consistency of treacle will be obtained. Cork dust may be added to this mixture, and the resulting compound, when dry, will be quite insoluble in water.

Chain Line and Tread of Cycle.—The term "chain line" applied to a cycle is the distance from the centre of the machine to the centre of the chain wheel. Thus, a 1½-in. chain-line hub would measure 1½-in. from midway between the apoke flanges to the centre of the chain wheel. A frame is measured from the centre of the bottom bracket to the centre of the large chain-wheel teeth. The chain line of hub and frame should, of course, coincide. By "tread" is meant the overall width of the bottom bracket axle. The extra width of 5½ in. and 5½ in. to take the gear case has the crank boss much wider to throw the crank farther from the chain wheel to give the necessary clearance.

Lead Soakers on Hip of Slated Roof.—In the illustration let Fig. 1 be the plan of a fragment of a hip of a slated roof. The lead soakers are shown by dotted lines for the lower courses, and the top or last soaker is shaded and shown exposed as it would appear before the next course of slates is fixed in position. Fig. 2 is the shape to which the pieces of lead are to be cut. The figured dimensions are for small ladies slates, which measure 14 in. by 8 in., and are fixed with a 3-in. lap. The angle at A varies according to the angle of slope of roof, and a wise plan would be to fit one soaker and use it as a pattern for the remainder. Half way up the hip would





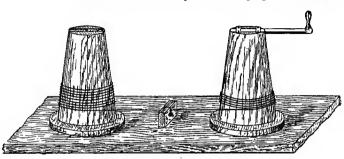
Lead Soakers on Hip of Slated Roof.

be the best position for fitting the pattern, as the angles between the top and bottom courses vary a little, according to the thickness of the tilting piece or pringing fixed under the eaves course of slates. The piece at V should not be out ont, as it is necessary for nailing to the roof. Hip scakers do not make a good job, as they necessitate several small pieces of slate that cannot very well be fixed by nailing.

Canning Meat.—In the usual canning process, the meat is first cut into suitable sized pieces, which are dropped into the cans and then the lids are soldered on; there are small openings in the lids to allow the air to escape. The cans are then placed in a closed boiler, and heated by steam at a temperature of 230° F. for a period of from one and a half to two hours; the boiler is then opened, the tins are quickly removed, and drops of solder run on the holes while steam is issuing. To ensure perfect sterilisation, the closed cans are heated at 240° F. for a short time. Or the process may be carried out in an open chloride-of-calcium bath, the temperature being raised from 180° to 230° F., and the cooking allowed to proceed for about four hours, when drops of solder are run on the holes while steam is issuing, and the heat raised to 260° F. for a short time. The bath is very large and shallow, half filled with a concentrated solution of calcium chloride, and heated by steam under pressure or by fire.

Drawing German-silver Wire.—To draw a quantity of about 101b. of No. 18 and No. 28 German-silver wire at one time, it will be necessary to fit up a strong bench with a set of wire-drawer's rolls, and draw the wire from one set to the other through the draw-plate. If the work is to be done by hand, the rolls should be conical, as shown in the sketch; from these the coil of wire can be easily removed when it requires annealing, and can be replaced when annealed. These rolls may be made of

oak, ash, beech, or any other hard wood. A convenient size will be 15 in. in height and 6 in. at the top, tapering down to 10 in. in diameter at the base. If power from a gas or steam engine is used, the shape and littings of the draw-bench should be modified. The rolls should be made of cast-iron 12 in. in diameter, with a face width of 2½ in. between the flanges. One of the flanges may be grooved to take a gut band, or a grooved projection of a smaller diameter may be arranged in casting the roll, to serve as a driving pulley. The roll spindles run in brackets fixed to the front of the bench, and are driven by gut bands from a live cylinder running beneath, with a lever arrangement to tighten the band as required. The draw-plates are held in a clutch attached to a steel guide-bar worked to and fro by eccentric gearing at the end of the bench. The rolls may be driven at from 80 to 100 revolutions a minute. When the wire has been drawn through one hole, the filled roll is mounted in brackets on the bench, and the wire is drawn from the under part of the roll through the plate to the top part of the next roll. German-silver hardens quickly in drawing, and soon gets too hard to be drawn; it must then be made into an open coil on a tapering roll, and the coil annealed by heating the wire to redness in a charcoal fire. When the annealed wire has cooled, it should be steeped in a pickle composed of 1 part of sulphuric acid in 40 parts of water, to loosen the black scurf formed by heating the wire is taken out of the pickle, it should be rinsed in a pickle of soda or potash, then dipped in strong sospsuds and drawn whilst wet. The soapsnds will serve as a lubricant, and may be used on a sponge at the back of the draw-plate for this purpose. As the wire



Drawing German-silver Wire.

gets finer, it is apt to buckle in the coil, and cannot be coiled to anneal it. It must then be wound on copper hobbins or on hollow copper cylinders, then covered with several layers of paper and bound tight with fine copper wire. The filled cylinders should then be buried in red-hot ashes for an hour or so to anneal the wire; or they may be annealed in close annealing pots in a strong coke fire. If this is done properly, the wire will not be discoloured in annealing, and need not be pickled afterwards. In annealing German-silver, care must be taken to avoid overheating, since this has a tendency to darken the alloy by oxidising the zinc on its surface.

Use of Silde Rule.—The slide rule is for calculating mechanically by logarithmic computation. A 20-in. Gravet rule of seasoned mahogany with celluloid sceles is the best for office use, but a 10-in. rule is sufficient for ordinary work. There are four scales: A and D on the rule, B and C on the slide. The left index figure of the 0 and D scale may represent any value that is a multiple or sub-multiple of 10, as 1, 10, 100, or 0·1, 0·01, 0·001, etc., and this fixes the ratio of value of the whole scale. The same remarks apply to the A and B scales, but the second half of each will have a tenfold value; for example, left 10, centre 100, next figure 200. The C and D scales are used for multiplication, division, and proportion. For example:—

Multiplication set 1 on C | under h on C

| Multiplication | set lonc under b on C |
|-------------------|---------------------------|
| $a \times b = x$ | over a on D read won D |
| Division | set b on 0 under 1 on 0 |
| $\frac{a}{b} = x$ | over a on D read x on D |
| Proportion | set a on C under c on C |
| a:b::c:x | over b on D read x on D |

All slide rules are based on the same principles.

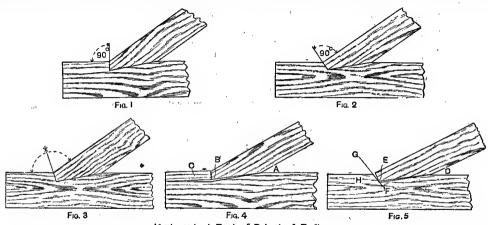
Coke for Melting Steel.—Patent coke is best for melting steel. This is specially made for casting purposes from well-washed and selected slack, and although it costs more than ordinary coke, yet it is more economical, as it lasts much longer, gives a greater heat, has the minimum of ash, and usually is free to a large extent from sulphur.

Interior Plastering of Concrete Houses — For plastering the interior of houses built of concrete. either Roman or Portland cement may be used. Roman cement, used in the proportion of 1 cement to 1 of sharp clean sand, is generally laid on in one thickness of from 1 in. to 3 in., the surface being afterwards finished with a thin coating of neat cement. The wall should first be thoroughly dry, roughened to form a key, well brushed to remove all dirt and dust, and well wetted just before applying the cement. Portland cement is used, and is applied in a similar manner, but in the proportion of 1 cement to 9 sand. The cost cannot be stated, as prices vary in different localities; 1 bushel of Roman cement with I bushel of sand will cover about 35 super. yd. 3 in. thick, and a plasterer with labourer and boy will render about 25 super. yd. per day; 1 bushel of Portland cement with 9 bushels of sand will cover about 14 super. yd., and the same three would be able to render about 22 super. yd. per day. For ceilings, ordinary lath and hair plaster are suitable.

Trueing and Packing Circular Saws.—In the case of a circular saw running slightly away from the fence when ripping long deals, first see that there is no end play in the saw-spindle, that it fits properly in the bearings, and is perfectly level and square with the bench. Run down or round the saw by placing a piece of grindstone in front of the saw-teeth while the saw is revolving. Now file or grind, as the case may be, alternate teeth from one side, then the

round two strips of wood of a length equal to the distance from the eye of the saw to the throat of the teeth. The general method is to grease and tuck some hemp on each side of the fore half of the saw. Such packing gives much trouble by causing the saw to run from a true path. If a new saw is of even tension, make the packing so that it will cause a little more warmth at the centre of the saw than at the rim. If a saw is loose at the centre (as it should be when new), make the packing so that it presses a little tighter at the rim. If packed tight at the centre, the plate will dish, and draw as noted above. The same will result from hot bearings. After putting in a long cut, place a straightedge against the saw, and if it is found to buige (dish) after the above advice has been followed, place the saw in competent hands to be hammered.

Abutment at Foot of Principal Rafters.—As regards the merits of various forms of abutment of the foot of principal rafters, take first the case of Fig. 1; assume that the sagging of the principal rafter would cause it to ride on the heel as shown at A (Fig. 4), the toe B would be raised and thus bring about the splitting of of the abutting piece c, as shown; whereas when the abutting surface is at right angles to the back of the principal rafter, as shown at Fig. 2, when the rafter sags and rides on the heel edge D (Fig. 5), the toe slides along F c, and, as will be seen, the rafter is not sufficiently indented to lever up the portion H and cause it to split off. The bisecting of the angle as shown at Fig. 3 is a kind of



Abutment at Foot of Principal Rafters.

remainder from the other side of the saw, so as to bring each toofh to a sharp point. In doing this, care should be taken that the top and face bevels in each range of the teeth and the rake (lead) are alike. If the bevels on the outside range, or the rake, are more acute than on the inside, the saw will tend to draw thick away from the fence, and vice vered. The saw being made perfectly round, and the bevels, rake, and length of teeth uniform, set each range of teeth carefully so that the set be also uniform. If the saw-plate is not crippled, and has been properly hammered, it should now be in good working condition. Avoid excessive rake or lead in the teeth, or they will draw and run from a true path. For ripping long deals a lead to an angle of 60° to 65° answers well. See that the collar washers are rather concave, otherwise, when cutting long stuff, undue friction will be set up on the saw-plate and it will draw out of line. The teeth should be fairly evenly spaced, or one range will have more work than the other range, consequently the saw will draw from or to the ience, as the case may be. See that the fence does not come beyond the points of the saw teeth, that it stands square with the table, and, if the saw draws a little, in some cases a slight adjustment of the fence will remove the trouble. The eye- and pln-holes of the saw should be an easy fit on the spindle and steady-pin. Although the above advice (which is important) may be carried out to the letter, if the saw is not properly packed trouble will ensue. It must be understood that the packing is not merely to support the saw, but its object is also to set up a certain amount of friction on the saw-plate, so as to cause an equal expansion in the plate. After a certain amount of work has been done with a circular saw, the plate does not remain in the same condition as when it was new. Therefore, the packing must be regulated so as to equalise the tension in the plate. The best way to make the backing is to pass some clean hemp

compromise, being, of course, a better method than that shown at Fig. 1, but not so good as that shown at Fig. 2.

Cleaning Red Felt Hats.—To clean red felt hats, they should be rubbed until they are thoroughly damped with a rag moistened with benzoline, and then hung out to dry, after which they should be brushed with a hard brush. If this treatment does not clean them thoroughly, wet a clean cloth with hot water, rub on it a little curd scap, and go over the hats carefully so as to wet them as little as possible; then finish with a clean cloth and hot water without scap. Dry the hats slowly, and iron the brims with a hot iron.

Chocolate Colour Paint.—The following formulæ will be suitable for a chocolate paint for use on either woodwork or ironwork, if made from good, quality paste paints: Indian red 8 lb., ivory black 1 lb., patent driers I lb., boiled oil 1 pt., and American turpentine 4 pt. If a glossy finish is required, prime the work with the paint, and for the finishing coat omit 4 pt. of boiled oil and replace with best oak varnish. By varying the proportions of black paint any desired shade of chocolate may be obtained.

Disguising Smell of Cheap Turpentine Substitutes.

The smell of cheap turpentine substitutes cannot be removed entirely, but it can be disguised somewhat by agitating the liquid with a little weak soda lye and then with a little sulphuric acid.

Test for Quick Liquid Driers. — To test quick liquid driers such as are used in paint, allow a portion to stand uncovered; if on the evaporation of the benzine a separation is shown, the driers contain resinate of lead; if no separation takes place, the base is pure oil drier.

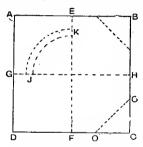
Repairing Painter's Dusting Brush.—The hairs of a dusting brush are apt to fall out either through the shrinkage of the hairs or by the perishing of the cement which originally bound the hairs together. Brushes should never be kept in too hot or too dry a place. All kinds of hairs absorb moisture, and, if this entirely evaporates, the hairs lose bulk and come away from the binding. To repair the brush, remove the ferrule and handle, and replace the hair which has come away, putting the butt ends of the hair together, then dipping the end in hot pitch or glue to the depth of ½ in., allowing the binding to enter between the hair ends. Then take a piece of thin wire, about 1 ft. long, tie up the bunch of hair at the base, and dip it again in the hot binding pitch or glue. Now fasten on the ferrule, and then drive in the wedge end of the brush handle. In performing this operation a vice should be used. Finally force in the round piece of wood which serves as a base to the hairs.

Properties of Achromatic Object Glass. matic object glass is one in which the light is all brought to one focus, and which shows one clear, sharp, and colourless image. In ordinary object glasses there is a very slight amount of outstanding unfocussed colour round the image of a very bright object due to the secondary spectrum.

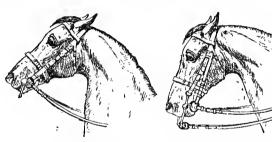
Moulded Stone Pedestals.—To make a circular pedestal in stone, the hetter way would be to put the block of stone (if not too hard) in a lathe, and turn it to the required shape. To work the pedestal by hand would be very costly, and, moreover, it could not possibly be so true when finished as a pedestal turned in the lathe. To work the pedestal, first make a sheet-zinc mould to the exact size, showing the contour of the mouldings; this mould will be similar to a

now be gradually raised to the height required by men working the crab. To prevent the truss swaying and doing damage during ascent, it would be guided by workmen holding ropes tied to it. The truss would next be placed as nearly as possible in its position, then plumbed, adjusted, and stayed temporarily with pieces of timber attached to the plate, or other convenient fixing, until it could be connected to others by purlins, ridge, etc. At the present time derrick cranes are frequently used for hoisting, in which case the trusses would be raised, guided, and placed in position more speedily than by the method above described.

Pelham and Weymouth Bridles.—The Pelham bridle, illustrated below, is made like a riding bridle (see p. 223) as regards the head, but with a noseband, which is made singly or lined along the front part and stuffed; it is cut either straight or swelled in the front, the length helng 2 ft. 4 in. after adjusting the buckle. Any ornamental pattern in the stitching on the centre must be put through single leather, then lined, and the outer lines stitched. With a noseband the billets must be made a little longer, so that a space can be left between the two loops above the buckle unstitched for the noseband to run through both cheeks. The Pelham bridle also has two reins, one say I in. wide, and the other \(\frac{3}{2} \) in, the length being the same as the The Pelham bridle also has two reins, one say I in, wide, and the other \$\frac{1}{2}\$ in, the length being the same as the snaffle reins. They have billets at the ends, and the wide rein has a buckle at the top also, but the narrow rein is spliced together in the centre without a buckle. The bit has a curb and long cheek, with two rings for buckling the reins, the narrow one being at the bottom ring and the wide rein in the rein by the mouth. The Weymouth bridle (Fig. 2) has two heads and two bits, a hackney and a bradoon. The head fastening to the hackney bit is made as for the Pelham bridle, with a noseband, but the head fastened to the bradoon is made



Moulded Stone Pedestals.



Pelham Bridle.

Weymouth Bridle.

full-size elevation of the pedestal. Procure a piece of stone of a size which will enclose the pedestal, square it up into a rectangular block, and mark on the centre lines at each end (or top and bottom), as E F and G H, care being taken that these are out of twist or in the same vertical planes. Scribe the face mould on the two sides A B and C D and work through as for a square pedestal. Then put the mitre lines on for each external angle, and work the remaining two sides. The pedestal is now a square, and the only portion of this wanted is on the vertical lines at E, F, G, and H. If, by means of reverses, this contour could he cut in correctly, there would be no need of working it square through; however, in working it as described, the mason would know just where to put in the necessary work. Make quadrant templates to the various diameters as J K and round off the square corners, being guided by vertical reverses to completion. For the octagonal pedestal, first work the mouldings square through as above described; then put on the vertical mitre lines for the octagon as at o o, cut off the four cants, and return the mouldings. Another way is to first work the pedestal as an octagonal prism. Make a stretching mould, that is, a full-size vertical profile of the mouldings), which will be somewhat elongated when applied to the splay face, but will be correct when worked through, and will perhaps effect a saving of time in execution. The hexagonal prism may be worked similarly.

Putting Large Roof Truss in Position.—To put in position, say, a large hammer-beam roof truss, 50-ft. span, a derrick would be erected and held in nearly an upright position by guy ropes. A block and tackle would be secured to the top of the derrick, at the lower end of which a single block would be fixed. The other end of the tackle would be connected to the truss, and the free end of the cord would pass through the top block and down through the single pulley fixed at the lower end of the derrick, from which the cord would be continued and connected to a crab. The truss would

with one cheek only, about lin longer than the cheek of the other head, and from the other side is one strap with a billet and buckle at the bit; it passes over the head under the other headpiece, and underneath through the forehead band loop below the other headpiece, and buckles in the cheek on the off side. This second head is \(\frac{3}{2}\) in. wide, and the long side is about 2 ft. 9 in. long. The two reins must be exactly like the Pelham reins. Bridles are made in different styles, and with fancy patterns; for example, rounded cheeks and part length rounded reins, leather rosettes, platted throat lash with tassels, plaited fringe on noseband, etc.

Removing Copper or Lead from Mercury.—Pour over the mercury warm diluted nitric acid and stlrring at intervals of thirty minutes for about four hours; this method suffices for small quantities of copper or lead, larger quantities of which are removed by heating in a retort, the mercury being covered by powdered charcoal, 1½ in. thick.

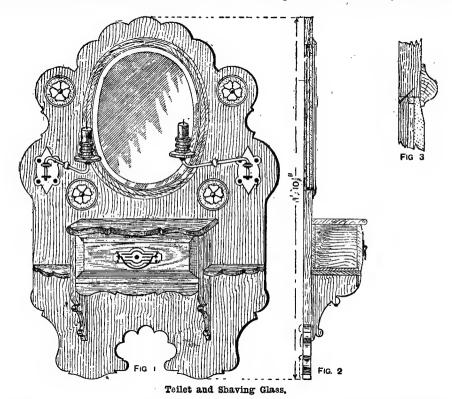
Silver Wire Toast-rack—A good pattern rack to make of wire is one composed of the letters TOAST worked out in fancy form and soldered upright on a sound base, the handle being placed upon the centre letter A. The wire should be bent with the fingers only, or with round pieces of soft wood cut to the desired form. The soldered joints should be made with silver solder, obtainable from any jeweller's. This meits at a red heat, and borax and water paste must be used as a flux. To clean after soldering, plunge the article while hot into sulphuric acid 1 part, water 9 parts, and then wash well. To finish off, scour with fine emery cloth, smooth with rottenstone on a rag, and polish with ronge and water on a lathe mop, or on the palm of the hand. Give the rack to a jeweller to get it hall-marked, but make sure that only standard silver is used in its mannfacture, or it may be broken up at the assay office. it may be broken up at the assay office.

Lining Brasses with White Metal.—In large bearings the brasses are usually lined with white-metal. It a heavy shaft should get slightly out of its true line, the pressure will probably be thrown towards one end, and if the step is quite rigid, the bearing surface will be diminished. A white-metal lining would accommodate itself to the pressure until a more or less uniform bearing surface is obtained.

Draining Basin of Garden Fountain.—If a fish basin is emptied only at long intervals, and the nearest drain is some 20 ft. from the basin, it would probably he easier to draw off the water by means of a syphon. This could be contrived by garden hose, either rubber or woven. The woven hose is made of larger diameter than the rubber hose, and is proportionately cheaper and more efficient. At the end inserted in the hasin a plece of metal pipe would be required, bent to bring the water over the edge of the basin, which would bend off the flexible hose so sharply as to stop the current. The other end of the pipe would have to terminate over a sink at a lower level than that of the bottom of the

when they were filled with water. The real cause of the wetness is the condensation on the cold pipes of moisture suspended in the air. In a case, for instance, in which such condensation occurs on pipes situated in a basement kitchen, there is little doubt the ventilating arrangements are not entirely satisfactory, and watery vapour, or steam, from the cooking appliances condenses in the form of water on the cold pipes. The remedy is to ventilate the kitchen and encase the pipes, or cover them with non-conducting material. Even a couple of thicknesses of brown paper, or two or three coats of linewash, on the pipes will sometimes prevent condensation.

Design for Tollet and Shaving Glass.—The toilet and shaving glass illustrated by Fig. 1 is best made in a dark wood, and walnut or mahogany will look well. The back is in. thick, and of the dimensions given in Figs. 2 and 4. It should be marked out and cut with a band or scroli saw. The oval plate glass measures 9 in. by 7 in., with a bevel § in. wide. The opening is cut in the back piece to fit the mirror, the moulding being



basin. To start the syphon, the pipe would have to he filled, or partly filled, with water, and the sink end then pinched together. The two ends would then have to be placed in the basin and over the sink respectively; then the end at the sink must be allowed to open, and the flow would continue till air commenced to get in at the basin end. A small cup-like depression at the lowest part of the basin, for the tube end to dip into, would make the emptying process very complete. The fish had best be enticed into a pan by the offer of food, and then removed bodily, or else caught in a net and put into a pail till after the basin is ready for them once more. If the basin is well stocked with plants, the water does not want changing; so, if the bottom part is muddy, put the syphon in action, and go over it with the suction end to draw ail the water up; and clear the scum off the top in the same way. The fish will not get sucked in if due care be taken; a nip of the hose between the finger and thumb will instantly stop the flow if any fish is seen to be drawn dangerously near.

Water Pipes Sweating.—There is a popular notion that, at times, water will ooze through the material of which pipes are made, but this is a fallacy. If it were true, the pipes would always be wet on the outside

made ½ in. (tuil) smaller all round inside, and when fixed in position forms a rebate for the plate, as shown in Fig. 2, and, enlarged, in Fig. 5. The moulding may be turned in one plece in an oval turning lathe, or a circular ring may be turned to section, and when cut to the lines A (Fig. 4) will form the top and bottom of the moulding; the intermediate pleces may be fitted and worked to shape by hand. Between the mirror and its backing a soft wood ring is shown. This is cut with a freisaw from ordinary picture backing to the size of the mirror outside and about ½ in. wide. This allows the backing to support the glass all round the edge, but prevents it rubbing the silvering. Fig. 7 shows enlarged a conventional flower design, four of which are marked on the foundation. They should be sunk ½ in. all round at the dotted parts, leaving the design standing out at the original level; the outline is cut with a veining tooi. The drawer is 7½ in. by 3 in. by 3 in. outside, and the top shelf (Fig. 5) over the drawer and the side brackets (Fig. 8) are ½ in, thick. The two small side shelves (Fig. 6) are also ½ in, thick. The two small side shelves (Fig. 6) are also ½ in, thick. The outside edges of the top shelf-should be rounded as shown at Fig. 1. A piece, 7½ in. by 3 in. by ¾ in. thick, is fixed between the side brackets to carry the drawer as shown in section, Fig. 2. The ornamental

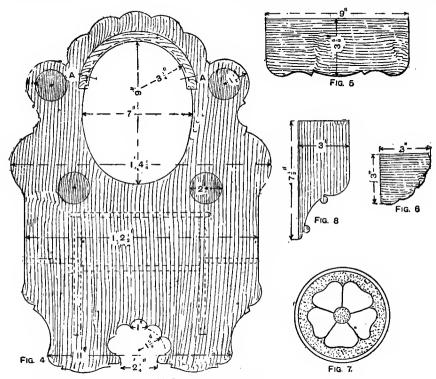
strip below this piece is \$\frac{1}{2}\$ in, thick and \$1\$ in. wide, and is fixed \$\frac{1}{2}\$ in, back from the front edge. A brass drop handle is screwed to the drawer front as shown, after all pieces are fixed as indicated by dotted lines at Fig. 4, the whole may be shellac-varnished or French-polished, after which the candle sconces may be fixed in position. The finished article may be hung by means of ordinary brass eyeplates.

Silvering Painted Glass.—When a painted design on glass is to be backed up with silver, if the painting nearly covers the glass, it would be simpler to cover the part to be silvered with silver leaf and burnish it in the same way as gold is burnished. The silver can be obtained in books. The glass should be well cleaned, and a weak solution of isinglass laid freely on it. The silver leaf should then be laid on and allowed to dry, the silver being burnished by hot water, which must not be allowed to go on the painted design or it might be disturbed.

Adjusting Lumpy Level.-The level should be care-

turn the telescope one quarter round—that is, over the pair of conjugate screws—and level again; turn the telescope back to its first position and level again; and so on, until the telescope is level in both positions. Now, turn the telescope one half round; if the bubble is in the centre there is no error; if the bubble is not in the centre, bring it half back by the capstan screws at the end of the bubble tube and half by the screws under the frame of the telescope.

Dividing Vernier.—For dividing scales, mathematical instrument makers use a dividing engine; all other methods are makeshifts and liable to error. A dividing engine consists of a bed-plate, to which the scale is clamped, and a slide parallel to it. The slide is operated by an accurate screw with a large divided head, and is, in fact, a micrometer. By its means the slides can be advanced any number of turns of the screw. The slide carries a diamond point, with which the rule is marked at each division. A vernier to read the tenths of a division of the scale must have a length equal to nine divisions of the scale. This length must be divided into



Toilet and Shaving Glass.

fully tested in the manner described below. Drive down three stakes 5 chains apart (call them A, B, and C), and, placing the instrument halfway between each pair, find the several correct heights of each. Let A = 10000 ft., B = 10420 ft., and C = 10280 ft. Now place the instrument close to A, and find the heights; if they are the same as before, the instrument is in adjustment. For the sake of getting an example, however, let the heights be A = 10000, B = 10400, and C = 10260; that is, A being the constant, the reading of B is 20 lower than it should be, and so is that of C; but if A B is equal to B C, which is the case, both being 5 chains in length, if the bubble points 20 too low at B, it should be 40 at C; the 20, therefore, is owing to an error in the line of collimation. In order to correct this error, use the small screws at the eyeplece of the telescope, and move the web until the reading at B, deducted from the present reading, becomes just half of the reading of C deducted from its present reading; this will give the adjustment for the line of collimation. Having now got the line of collimation branched to the bubble, the next adjustment to the vertical axis; or, in other words, that the bubble be in the centre throughout a complete revolution. Set the telescope over any two opposite screws and level;

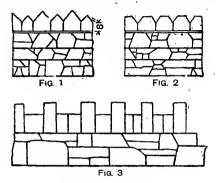
ten equal parts. For dividing, a mandrel or a watch lathe may be used. The vernier may be clamped to the face-plate and the face-plate wedged immovably. A fine pointed cutter can be put in the rest, and the screw of the bottom slide used as a micrometer. A temporary division plate may be fixed to the handle, also a pointer to show small portions of a revolution. Traverse the slide until the cutter travels from end to end of the vernier. Count the revolutions made by the screw. Suppose there are 227; then 227 ÷ 9 = 252 will be the distance between each division. This distance will be the first division, and so on.

Softening Pump Leathers.—Some waters have a tendency to make pump leathers hard. Try thoroughly soaking the leathers in castor oil until this has penetrated into the pores. If this does not prove a remedy, dress the new leathers with a lubricant composed of 4 parts of best linseed oil, 2 parts of olive oil, 1 part of spirit of turpentine, 2 parts of castor oil, 2 part of beeswax, and 2 part of pitch. Boil these together in an earthen vessel over a gentle fire, and during ebuilition dip in the leathers and allow them to remain for a few minutes; fifteen minutes is sufficient for thick leathers.

Blackening Deminees.—For hone dominees, black japan should be first warmed over a fire to render it fluid, and then applied by means of a hog-hair fitch brush or German domed camel-hair brush. If used in a warm atmosphere free from dust, the japan will dry with a hard uniform brilliant finish. It should be applied sparingly. For cheap wooden dominoes, a black ebony stain and varnish combined will be most suitable. Dissolve 6 oz. of orange sheliac in 1 pt. of methylated spirit, adding sufficient aniline black to obtain the desired colour. Apply with a sable-hair brush. Either of the above may be obtained from most oil and colourmen.

Simple Remedy for Rusty Boilers,—Galvanised fron boilers ("copper" boilers), after two or three years' use, begin to mark the clothes with iron-mould, although no trace of rust may be seen. The fault may be remedied in the following manner: The inside is made as clean as possible, and then dried, when a good thick coating of limewash is applied and allowed to dry before the copper is used. This application of limewash requires renewing once in four or five months, but even if the renewal of the limewash is required more frequently, the trouble involved is not very great. The limewash does not harm the clothes.

Scotch Coping or Finish for Masonry Walls.—The term "Scotch coping" is used in the north of Ireland and elsewhere to indicate the coping used on rubble masonry boundary walls. It consists of flat bedded stones 9 in. to 1 ft. 4 in. long on bed, and 9 in. to 1 ft. 4 in. high, laid on a thick bed of cement mortar, and oversalling the face-line of the wall from 3 in. to 1 in.



Masonry Walls.

The heart of the wall is flushed up with cement mortar and spalls, in order to throw the water to the outside. The joints are pitched vertical for about 6 in., and squared as far as possible to the centre of the wall. The stones are mostly built high and low alternately (see Figs. 1 and 3), but sometimes are kept nearly all of the same height (see Fig. 2).

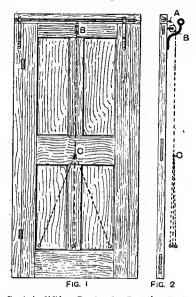
Fireproof Paint.—Silicate of soda has been used for protecting woodwork (principally interior) against fire. The silicate is thinned down with hot water, and two or more coats are applied to the woodwork. Another method is to mix equal parts of finely powdered asbestos and slaked lime, adding a very small proportion of boiled oil as a binding agent, and thinning the whole down with silicate of soda colution. Mineral colours may be added as desired. Washable distemper paints for both interior and exterior use minimise the risk somewhat as against oil paints.

Special Solders.—A solder that melts at 150° F. is composed of 15 parts of bismuth, 8 parts of lead, 4 parts of tin, and 3 parts of cadmium. Another solder that melts at 200° F. is composed of 2 parts of bismuth, 1 part of tin, and 1 part of lead. When making either of these siloys, melt the metal with the highest melting point first, and then add the remaining metals; well stir the whole, and cast into ingots or strips for solder. For fluxes, oil or tailow used on a clean metallic surface is necessary when soldering with the above alloys.

Measuring and Charging Bricklayers' Work.—In London, brickwork is measured by the rod of 272 super. ft., or 303 super yd. of the standard thickness of 1 ft. i in. In the North of England it is measured by the superficial yard, 9 in. thick. The openings should not be measured as brickwork, but should be measured and charged separately to cover extra labour in forming and plumbing angles and returns. Probable cost is very difficult to estimate, depending upon the speed of the

man, the rate of wages in the district, etc. A bricklayer and labourer may lay 1 super. yd. per hour = 1s. 6d. for wages; 1 super yd. of brickwork 9 in. thick takes 90 bricks (at, say, 25s. per 1,000) = 2s. 3d.; and 1½ cwt. mortar (at, say, 6s. per ton) = 5d.; or a total of 4s. 2d. If the openings are large and eastly worked round, 2d. or 3d. per yard may suffice; if small and entailing much labour, 9d. to 1s. per yard. Extra charge is also made for setting steps, sills, lintels, arches, wallplates, building in frames, round ends of beams, etc.

Curtain-lifting Device for Portière Red.—When a portière rod for curtains has heen fixed, much additional comfort is gained if the curtain is long enough to allow a few inches to lie on the floor, so as to exclude the draught coming under the door; but this in the ordinary way would necessitate the curtain being lifted up and fastened when anyone required to pass in and out of the room. If, however, the simple expedient shown in the accompanying filiustrations is adopted, this inconvenience is removed, and the curtain is raised from the floor and lowered again each time the door is opened and shut. In about the centre of the framing around the door at the top is inserted a small screw eye A (Fig. 2) to which a length of cord is attached.



Curtain-lifting Device for Portlère Rod.

This cord is passed over the pulley B (Figs. 1 and 2), fixed in the top of the door itself, and is continued underneath the curtain to C, where it is joined to three other cords terminating in three small rings sewn to the inside of the curtain about 1 ft. or so from the bottom. Thus every time the door is opened the curtain is raised by the strings pulling it upwards. A modification of this pian is to have, instead of the rings, a thin lath sewn inside the curtain, to which two cords only are attached.

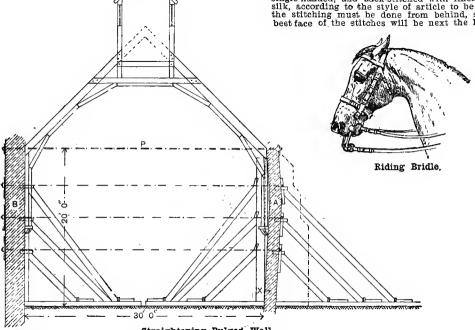
Reviver for Patent Leather.—To make this, mix warm linseed oil 1 pt., and cream 1 pt. Apply with a sponge and polish with a soft flannel or rag.

cot Mattress.—The following instructions refer to a cot mattress 4 ft. by 2 ft. Ticking for mattress making is sold 4 ft. 10 in. wide. In order to economise material, for a cot the width of the ticking can be used for the length. In cutting, allow \(\frac{1}{2} \) in. to the foot both ways. The borders, which should he 4 in. deep, should be cut on the cross from fancy Belgian ticking. The cases are seamed right side out, the seams being strapped with mattress ribbon. Twenty pounds of wool flock, or 10 lb. of wool and 8 lb. of hair, will be sufficient, providing the materials are of fair quality. Tuft with 9-in. diamonds, using crimson felt. To set the borders, they will require blind-stitching with two rows. For spring woven-wire matresses, a French overlay is generally used; these overlays are cut without borders, simply allowing 1 in. to the foot for fulness; then seam the wrong side out, leaving a space for the fillings, then work out the top even, and tuft. These mattresses will finish about 3 in. thick, and for fillings allow 6 lb. to the foot in wool or 5 lb. in hafr.

Straightening Bulging Wall.—It is quite possible to bring a bulged wall back to a vertical position, but great care is required in the operation, as well as liberal expenditure on temporary shoring. The best method of straightening is to use iron tie-rods, and pull the wall into position, erecting a set of shores outside to prevent the wall returning to its present position during the operation, another set of shores inside to prevent the walls being pulled inwards too far, and a third set against the opposite wall to prevent that being pulled over. The first operation will be to fix a number of wrought-iron tie-rods of say 1½ in. diameter, passing through the walls, with nuts and large S-shaped washers at each end. By inspection it will be seen that as the wall straightens it will turn on a fulcrum at or near x in the figure; here the mortar must be cut out from the widest joint in the brickwork to the extent of half the thickness of the wall, and, as the cutting is done, the fissure must be filled with dry sand. Sets of shores are then to be erected along the wall B, and it is

opened must be raked out and pointed. Some of the tie-rods may be left in, the others being removed; but if it is desired to remove all the tie-rods, strong but-tresses built in cement mortar should be erected on wresses must in cement mortar should be erected on the outside, more especially opposite the feet of the roof principals, and after being left for a couple of weeks to set, the tie-rods may be removed. The bulging being due to the roof principals, it will be necessary to tie their feet together, as shown in the sketch, in which P indicates the permanent tie-rod.

Making Riding Bridles.—For riding bridles (see the illustration), the buckles are made square, round, or fancy shape, and are of brass, tinned or plated. A snaffle bridle is a single head and rein bridle, the cheeks being about \(\frac{2}{2} \) in. wide and \(\frac{2}{2} \) in. long. The cheeks must have a buckle at each end, one with a chape turned down, and the other on the flat end of the strap, without turning, and with the billet underneath. Leave space for a loop before the buckle and the point of the cheek, the billet being placed far enough behind the buckle for two loops; a runner loop is needed on the cheek, and another stitched with the chape at the buckle, the billet being cut \(\frac{2}{2} \) in. long. They should be stitched in single-handed, and back-stitched with linen thread or silk, according to the style of article to be made. All the stitching must be done from behind, so that the best face of the stitches will be next the horse when Making Riding Bridles .- For riding bridles (see the



Straightening Bulged Wall

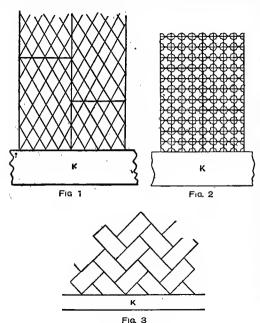
preferable to have as many raking struts as there are tie-rods, and the head of each strut should be fixed close to the point where the tie-rod passes through the wall. Sets of struts are then to be erected on the inside of the bulged wall, and so arranged that they support baulks of timber touching the wall at the base, and they should set perpendicularly, not against the face of the wall, for their whole height, the object being to bring the wall to the uprights and no farther. The last sets of struts are erected on the outside, and are so arranged that each strut is independent of the others. As the wall is pulled in, each strut will require adjusting separately, those pieces against the part most bulged requiring to be moved more than the others. It would be better to fix these struts before doing anything, as they will prevent the wall hulging farther during in position, and a sufficient number of men in attendance, the rods are screwed as tight as may be and then heated by means of oil lamps, which may be held at short distances apart along their entire length. The tie-rods expand longitudinally, pushing their ends outwards with the nuts, which are then screwed tight, and the rods allowed to cool, drawing the walls into position as they contract. The external shores are then wedged up, and the operation is repeated as often as necessary—that is, until the inner face of the wall touches the uprights of the inside shores. The sand-joint must then be cleared out and filled with cement mortar, and all joints which have

the bridle is on. Make one hole in each billet, leaving enough material to pass through the two loops and cover the stitches. The cheeks being finished, cut the head strap 1½ in. by 1 ft. 10 in., and silt it for 5 in. on each side. The width of this strap varies with that of the cheeks and throat lash. A ½-in. cheek should be silt ½ in. on one side and ½ in. for a ½-in. throat lash, taking care that the wide silts are both on the same side in each end. After punching four holes in the wide silt, and six closer together in the narrow ones, make the front ½ in. by 1 ft. ½ in. from the end of one bend to the other, after bending. Turn it over the head strap, and mark a line across close to the head strap, thus having 1 ft. 1 in. between the cross lines. Stitch the ends down, with a row along each side, and make the throat lash ¾ in. by 1 ft. 7 in., after turning down for the buckles. Put two runner loops on the threat lash in addition to the loops at the buckles of each end. Then cut the reins, the dimensions of which are 1 in. or ½ in. by 4 ft. Prepare them for the buckles like the bottom of the cheeks in the flat, place a ½-in. covered buckle at the other end, narrowing the chape down to the width of the buckle and the end of the other rein also for buckling. Put in the billets, with one loop before the buckle and two behind, and always put the strong end of the rein in the billet end; the length of the billets is 10 in. Sometimes the bridle is made without any billets, the cheeks and the reins being stitched fast to the bit; but the advantage of the other method in making it possible to remove the bit is evident.

Brick Pavements.—The use of bricks as a paving material for footpaths is common in many parts of England. One of the chief points in their favour is that bricks are easily laid, and are easily removed when it is necessary to lay or repair gas-pipes or water-pipes, or omake connections with house drains. Bricks are comparatively cheap, and are not unpleasant to walk on, giving a better foothold in winter than a smooth flagged or asphalted pavement. The dark colour of the Stafford-shire blue brick is objected to by some persons, but it is certainly to be preferred, under a glazing sun, to the light colour of a flagged pavement, which reflects the sunlight up into the eyes. When laid with a broad stone coping, bricks are decidedly neat in appearance. The objections to brick pavements are that, like all pavements with many joints, they cannot be kept so clean as asphalt, tar paving, or monolith cement paving. They are also apt to sink locally, forming hollows; and when the bricks are not sufficiently burnt, the outer surface wears off and shows the interior red colour of the brick. The stress in use are very numerous, including such sizes as I it. square, 10 in. by 5 in., 8\frac{3}{2} in. by 4\frac{1}{2} in. 9 in. by 5 in., and 7 in. by 4\frac{3}{2} in. In thickness also varies from 1\frac{1}{2} in, to 3 in. thick. In America, ordinary plain-faced bricks are used, but in England they are usually ornamented; examples of ornamentation are the

are drilled from 5 ft. to 8 ft. apart, the distance varying according to the softness of the rock, the depth to which they are to be taken, the size of the charge, etc. The best depth for economical working its from 5 ft. to 6½ ft. When 1t becomes necessary to remove a greater depth, it is better to do the work at two operations, removing the first layer before commencing the second. The holes should be taken from 1 ft. to 2 ft. 6 in. below the level of the intended finished surface. The dynamite may be obtained either in cartridges or in bulk, the former being the better and safer method. The cartridges used at Palermo Harbour were about 1 ft. in length, and each contained about 1½ fb. At Panama thirty-five to forty mines were fired simultaneously by electricity. The dynamite is exploded by means of an intermediary, fulminate of mercury or similar material, and this explodes the dynamite. After the blast, the rock is dredged out. are drilled from 5 ft. to 8 ft. apart, the distance varying

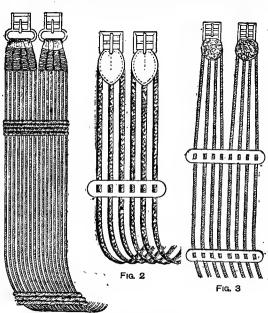
Saddle Girths.—Saddle girths (shown by Figs. 1 to 3 accompanying) are made of linen, worsfed, or union—that is, part linen and part wool—they are also made of raw hide, whipcord, and platted brown leather. It is, however, more common to employ the first-named material. Girth buckles must be obtained with safety



Brick Pavements.

diamond pattern (Fig. 1) and the rosette pattern (Fig. 2). The hardest bricks are made of blue Staffordshire vitrified stoneware, but red and buff bricks are obtainable, and are useful for forming ornamental panels in spaces before shops which are set back from the line of footpath, round central lamps, or in similar positions. As a rule, they are laid in straight courses across the line of the footpath, as indicated in Fig. 1 (as signifying the kerb), but in some towns they are laid in herringbone fashion, as shown in Fig. 3. As to the foundations and the manner of laying the bricks there seems to be much diversity of practice amongst town surveyors. Sometimes a concrete foundation is prepared, on which the bricks are bedded on a thin layer of cinders or sand; sometimes hard ballast is used for the foundation.

Dynamite Blasting in Deep Water.—A rectangular, flat-bottomed scow, or a raft of large size, say 40 ft. by 60 ft., is used as a staging for the work; the drills may be worked either through the bottom or over the edge of the raft, as may be found most desirable; a heavy cast-iron pipe, resting on the rock to be blasted, stands up a short distance above the surface of the water, and serves a fourfold purpose—it serves for guiding the drill, it prevents the blasting hole being lost when the drill is drawn up, it prevents sand and shingle being washed into the hole, and finally it forms a channel for the introduction of the dynamite cartridge. The holes

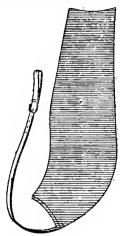


Saddle Girths.

bars across them, and the chapes should be cut pointed at the ends, swelling out at the sides to grow narrow to the width of the buckle at the top, where they bend. Always stitch them round, and put a straight line in the centre to keep down the point of the turn-down; only about twelve or fifteen stitches are put in the centre. When this has been cut and prepared for the buckle, stain the edges and turn in both corners of the web to meet in the centre; then run a stitch through them to meet in the centre; then run a stitch through them to meet in the chapes and buckles before stitching. The length varies from 3 ft. to 3 ft. 6 in. A Fitzwilliam girth is made of web 5 in. wide, the ends-being bound with leather and a chape and buckle being placed on each side—that is, in each corner. two at each end of the girth. A 1-in. loop is then put across the girth, 5 in. from the end, on each side, and the loops are stitched across twice at each end, an opening being left in the middle for an ordinary girth to pass. A single ordinary girth but then be made, one end being placed through each of the loops, and the Fitzwilliam girth is complete. It is a very safe girth, and keeps the saddle steady in place. It so desired, chape punches can be used to cut out the chapes at one stroke, or for cutting partly round or cornered patterns the head knife may be used.

Plate Powder.—To make a plate powder to be used by saddlers, take as much sulphate of iron as will fill a clay pipe, keep it on the fire for a quarter of an hour, and mix with powdered chalk.

False Collars for Horses.—Horses' false collars (see the illustration) are very valuable when all other means of easing a collar have failed. They are made to fit inside a collar, but should not be so thick as to interfere with its size, even when quilted. Some are made single leather, and others one thickness of felt, and some are quilted. All are made alike in pattern, but the quilted ones need a little allowance for the stuffing and quilting, say l\(\frac{1}{2}\) in. wider: the shape is somewhat similar to that of a collar lining. A brown paper pattern can be cut out first to fit the collar, and then be manipulated so that the creases come out in the trimmings. Run a single thickness forward quite to the front to cover the wide part of the body of the collar well, and come out beyond the body all round about l\(\frac{1}{2}\) in. The single leather and felt collar must be cut to pattern, and seamed both ends together, with a strap and buckle at both sides and at the bottom to keep them in place. Crease the leather double with a hot iron along the edges, and, when felt is employed, it is advisable to place a thin piece of leather over all the joints and stitch it on each side of them, having previously joined the felt end to end. The felt must always be cut lengthwise, not crosswise, because it will only stretch across. To make a quilted collar, cut the leather 1\(\frac{1}{2}\) in. wider, but do not let it reach beyond the forewale outside. When cutting it, allow about l\(\frac{1}{2}\) in more in width than the finished size. Four pieces of basil will be needed,



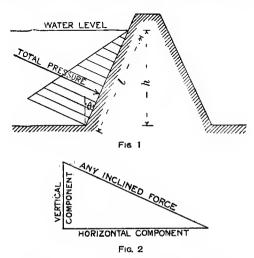
False Collar for Horses.

two for each side reversed; each pair must be stitched together, whipped over the edges with the flesh outside and the ends stitched together, so as to form a bag from end to end. Having cut a hole so that it will be out of sight when finished on the side next the collar, turn the collar inside out, and cut a similar, though smaller, hole in the other side. Both sides can now be stuffed separately through these holes. A piece of strong, fine cane will be required, long enough to run all round the hollow between the body and forewale of the collar inside, meeting in the point at the top. Put it through one of the holes in front of the false collar, and spot it in, drawing the leather tightly over it all round. Thus, when the collar is finished, the cane will fit into this hollow with a spring, keeping it in place close to the body. After that, stuff the collar with fine flock, putting more stuffing at the draught if necessary, and then quilt it and stitch up the holes in the sides. Run a row of quilting along the outside near the edge first, and then two rows inside towards the cane, a very small tuft of wool being also placed inside under every sitch. The thread must not be cut and knotted at each stitch, but should be just pulled home, and the thread run from one stitch to the other; it must be smooth and even all over, not baggy. Finally, place it in its position, and catch it as firmly as possible with the spring cane in the hollow under the forewale.

Water Collecting in Gas-pipes.—The condensation found in gas-pipes and fittings is principally water thrown down from the gas by the cooling and condensing action of the air, and this condensation may contain a certain proportion of the hydro-carbons, which are the light-giving portions of the constituents of the gas. On this account the condensation in gas-pipes should be avoided as far as possible. There is a possibility of a portion of the moisture arising from the water in the

meter, but in this case the gas must have passed through different temperatures before arriving at the meter, or it would not take up any moisture from it. Where compo. tube is laid in damp plaster, that material acts as a very efficient condenser, which, if the gas has passed through pipes laid in a warm ceiling, would quickly cause moisture to accumulate in any slight bend in the pipe. Compo. tube of ½-in. diameter is so very slight that it easily dips sufficiently to permit of an accumulation of moisture, which would be enough to cause jumping lights.

Calculating Water Pressure on Reservoir Dam.—Water pressure always acts perpendicularly upon the containing surface; hence, on an inclined face inside a reservoir the pressure per square foot will be represented by the ordinates to a right-angled triangle whose base lies along the whole length of the wetted face, and whose perpendicular from the lower end of the face equals the head of water h in feet multiplied by 62½ lb., the weight w of a cubic foot of water. The total pressure acting at one-third of the height for each foot of the length will be one-half w h l or one-half w h sec. 0, as in Fig. 1. This is the force line used in working out the stability of the dam, and any inclined force may be converted into its equivalent horizontal and vertical



Calculating Water Pressure on Reservoir Dam.

components by making a triangle whose base and per-pendicular shall be horizontal and vertical, and whose hypothenuse shall be equal and parallel to the given inclined force, as in Fig. 2. Fig. 1 illustrates a section of dam showing thrust from water, and Fig. 2 the triangle

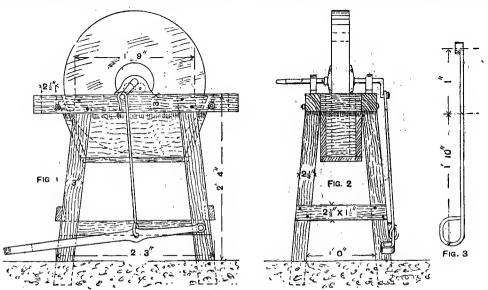
Preventing Indian Ink from Smudging.—To prevent Indian ink from smudging when coloured over, put a pleee of bichromate of potash, about the size of a pin's head, in the saucer, and rub it up with the ink. Do not use more, or it will run with a yellow stain on each side of the line. If the ink is not thoroughly ground up, it will have a tendency to run when washed over. Fixed liquid Indian or Chinese ink may be bought in shilling bottles (either Wolff's or Müller's) from most artists' colourmen. This ink will not wash

Plumber's Tool-bag.—The best material to use for a plumber's tool-bag is good Brussals or other carpet, and it should have a leather lining, which should be cut to the size required so as to avoid a seam at the bottom, and should be closely sewn up the sides. The carpet should then be cut to suit the leather, allowance being made for seams and for about 2½ in. to turn down at the top inside the leather; it should then be closely sewn, wrong side out, with strong carpet thread, after which it should be turned, the leather lining put inside, and the 2½ in. allowed at the top of the carpet turned down and closely sewn all round inside the leather. Holes should then be cut near the top, and eyelets, consisting of short pieces of compo pipe, tafted to the carpet inside and out, or, in place of eyelets, short pieces of leather strap may be riveted to the top of the bag, with brass rings to pass the cord through.

Frozen Gas-meters.—The best and quickest means of getting a light when the water in a wet gas-meter has frozen is to supply the meter with warm water until the ice thaws, when the surplus water will escape by the overflow. The water should be poured all over the meter, and afterwards in through the hole generally to be found on the right-hand side of the index-box and covered with a screw plug. The plug should be removed, as well as a smaller one at the bottom of the front box on the meter, either at the side or in front. The bottom hole is the outlet for the surplus water. After as much as possible of the water has run out, both the plugs should be returned to their places. But the necessity for thawing may in many cases be prevented by making a box somewhat larger than the meter, and filling the intervening space early in the winter with horse mannre, when the water will probably never freeze, and thus a great nuisance would be avoided. Another plan to prevent freezing is to mix a little glycerine with the water in the meter.

Fitting up Treadle Grindstone.—A 24-in. Yorkshire grindstone can be purchased for about 10s.; for joiners' tools a stone of fairly fine grit will be required.

additional pipes being added as the job proceeds, and, in some cases, heavy weights being put on to facilitate the cutting edge of the first pipe. The projecting flange on the cutside of the pipe has been found a nuisance, but one firm offered to make them with the flanges inside to overcome that difficulty. Shatis for mining purposes are sometimes sunk in running sand in the following manner: The excavation is started of much larger diameter at the surface than the outside of the brick lining. It is sunk, say, 6 ft. A crib is then laid on the bottom, and the sides have sheet pilling driven in close together right round. Another crib is fixed 3 ft. above the first one, and another at the surface; these are supported by props from the lower ones, or by cleats nailed to the piles, and may be fixed after six or eight piles are driven. Another depth is then sunk, and the next piles are driven inside the lowest crib, thus reducing the diameter of the shaft, and so on till the sand is passed through. Sometimes, when the sides do not stand well, shorter piles have to be used. If the depth of the sand can be ascertained before commencing, then the top diameter must be increased by the number of pile lengths multiplied into twice the thickness of a crib and a pile, which will give the



Treadle Grindstone.

Fittings for a stone of this size, including roller bearings, spindle with cheek and washer, crank at one end and handle at the other, would cost about 4s. The stone can be fitted up with both foot and hand-power. Fig. 1 shows a side and Fig. 2 a front elevation of a wooden frame made of 3-in. by 23-in, soantling. The trough may be of 1-in. elm board, and will be found convenient for keeping the space below the stone clean and catching dirty water, but may be omitted if thought unnecessary. Fig. 3 gives a plan of the wrought-iron treadle, which is connected to the crank by a 3-in. iron rod. The handle, which should be removable, comes on the opposite side to that shown by Fig. 1, and when this is used the connecting-rod may be unhooked from the crank. The treadle may be made of 12-in. by 2-in. bar iron.

Sinking Well and Shafts in Running Sand.—In some cases it has been found advantageous to line the well with concrete or iron cylinders to a depth considerably below the water level, and continue to the surface with ordinary brick steining. In such cases the water has to come up through the hottom. If the lower part of the steining was built with brick in cement, or built dry, and then well puddled outside with clay, the same purpose would be attained; but this is difficult to do in a running sand. In any case the sand would "flow" in with the water, and require frequent dredging. If a pump is used for raising the water, the suction should dip into a tub, or other suitable vessel, sunk below the water line, but stood upon the sand bottom. Wells in water-laden strata have been sunk quickly and cheaply by means of 3-ft. diameter seconds quality socketed drain pipes. The sand is dug away from the inside until the pipe sinks into the ground,

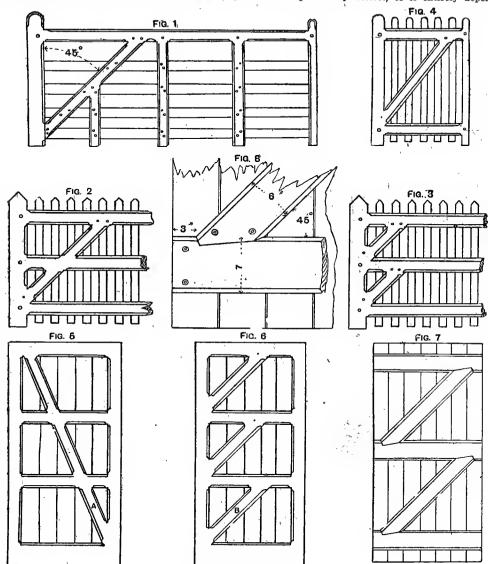
extra diameter required. The walling is then carried up inside the timbering, and, where the diameter increases, it is filled in between the back of the walling and the timber with dry material rammed solid. This appears at first an expensive method, but, when a running sand is to be contended with, often comes cheapest in the end.

Detecting Preservatives in Milk.—Mr. Wynter Blyth uses the following method to detect preservatives in milk: Ten cubic centimetres of each sample of milk to be tested and the same quantity of sterilised milk known to be quite pure are placed separately in glass tubes, and to each is added two cubic centimetres of a very strong solution of alkaline litmus. The tube containing the pure milk is named the "control tube," and if after the last treatment the other tubes are not of the same shade of blue as the control blue, add to them a semi-normal solution NaOH solution until the tints are identical. Plug each tube with cotton wool and heat in the water bath to 80 C. (176° F.) for ten minutes. After cooling inoculate each tube, including the control tube, with 0'5 cubic centimetre of a mixture of one volume of sour milk and 200 volumes of water, and then allow the tubes to stand at ordinary temperature for twenty-four bours, or even longer, until the contents of the control tube is white or very nearly so. If the other tubes originally contained pure milk they also will be white, but if preserves, are the preserve harness from the

Leather Preserve.—To preserve harness from the effect of ammonia in stables add a little glycerine to the oil employed.

Bracing Gates and Doors.—There is a correct position or angle of inclination for bracing gates and doors. If a gate is not braced in a proper manner, its usefulness and its period of service will be considerably shortened, owing to its falling at head and dragging on the ground. Fig. 1 represents the correct angle of inclination for a 9-ft. five-bar field gate. If a set square of 45° be placed against the back stile, the correct position will be obtained. Care should be taken that the foot of the brace sets against good sound stuff. When sap

results. It is a generally correct plan to place all braces at an angle of 45° with the horizontal. Of course, there are instances when, owing to the construction or width of the gate or door, this cannot be done. An instance of the impossibility of bracing a wicket at an angle of 45° is shown by Fig. 4. Fig. 5 shows a very common but incorrect method of bracing a framed ledged door. Supposing the lower portion of the brace (marked A) be removed or decayed, then the bracing becomes practically useless, or is entirely dependent



Bracing Gates and Doors.

occurs on the edge of the back stile, or at the bottom next the brace, the brace should be mortised and pinned into the top rail. Ordinary paled gates for 9-ft. openings are, in a great many instances, braced in an improper manner. The purpose of a brace is to keep the rails at right angles to the back stile, so as to prevent the head from dropping. If the brace (Fig. 2) be slightly perished, its usefulness is diminished considerably. In passing through the middle rail of the gate, the brace is halved or mortised; but the fitting of a brace into the middle rail either weakens the rail, if it be halved, or weakens the brace if it is mortised; both methods causing a bad joint, which retains moisture and hastens decay. The method shown in Fig. 3 gives better

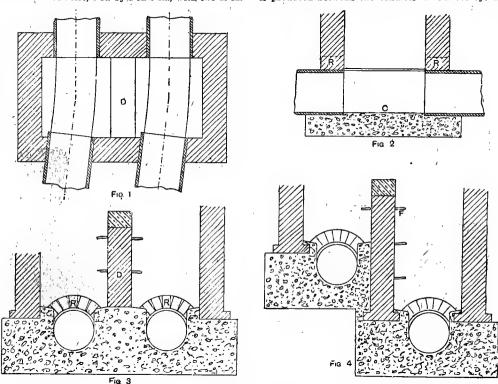
upon the nails in the ledges, which are not always sound; whereas, if the part marked B (Fig. 6) be removed, the bracing is but slightly affected. A great deal depends on the bracing having a sound seating. In the method shown in Fig. 5 decay generally commences at the seat of the brace, owing in part to the ready retention of moisture. Ordinary ledged doors, when braced, should have the braces let into the ledges as shown at Fig. 8, and about 3 in. from the end of the ledge. A very necessary precaution to take with ledged doors is to fix the ends of the ledges and the braces securely with screws or rivets, as shown in Fig. 7. For farm buildings, as the doors of stables, cowhouses, or plesties, it is absolutely necessary to use rivets for the ledges and braces.

Mica Flour.—Flour or powdered mica dates from 1870, when a patent was granted to Frederick Beck for a process for coating wall-paper and other surfaces with a mixture of ground mica and transparent varnish. So applied, the mica has a silvery lustre and sparkle which does not fade or tarnish with age, as all metals must sooner or later. The great cheapness of mica flour compared with metal dust caused the latter to be superseded entirely as an ingredient in wall-paper colours, and processes for gilding and colouring the former were invented. Now almost all of the cheaper wall-papers are decorated with mica paints, while the finely tinted grades are used even in the higher-priced papers. Mica flour has been a staple commodity in the market since 1890, but only within the last five years has the great development taken place. The industry continues to grow, though still confined wholly to the United States.

Manhole for Sewage and Surface Water.—Fig. 1 shows the plan, Figs. 2 and 3 transverse and longitudinal sections of a manhole, 5 ft. by 2 ft. 6 in., with two 15-in.

of glass for forcing purposes, and who often do their own glazing—is to omit the top putties altogether, the back putties being carefully laid, and in more liberal quantity than is usual in ordinary glazing; the glass is then thoroughly bedded, and sprigged or bradded to the sash bars, after which the putty is levelled off to the surface of the glass; a line of thick paint, extending in. or so over the glass, is then applied on each side of the bar. This makes a good watertight job, and, as compared with the prevailing method, breakages are more easily replaced, considerably less putty is used, and the rebates in the bars—for new work—need not be so deep. Between the two systems, both thoroughly done, there would be little to choose from a utilitarian point of view—appearance being beside the question—but the gardeners' system should be considerably the

Sparking Systems for Petrol Motors.—There are two systems of sparking in use for the ignition of the gaseous charge. In the contact spark system the spark is produced between two contacts within the cylinder,



Sewer Manholes.

pipe sewers at the same level, and with a division wall D 3 it. high to prevent the sewage overflowing into the surface-water drain, or vice vered, until there is at least 3 it. of extra water. If one sewer is at a higher level than the other, Fig. 4 shows how this may be arranged. The lettering signifies—c, concrete invert; F, foot-iron; and R, relieving arch.

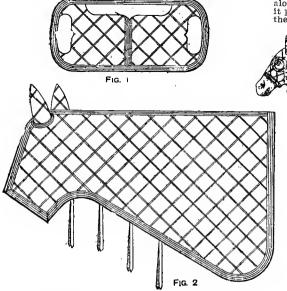
Glazing Garden Frames,—In glazing garden frames or lights, top putties are almost universally preferred. The chief disadvantage of this method for what may be termed horizontal work is the tendency of the top putties to come away from the glass (and frequently from the wood), in which case water is drawn in by capillary action, and if the defect is neglected the woodwork soon rots. But if the woodwork received a preliminary coat of paint in addition to the priming, and the edges of the glass were also painted, and if, in addition, the putties were painted as soon as the glazing was completed, and the paint was allowed to extend \$\frac{1}{2}\$ in. beyond the line of the putty—the work receiving at least two (three would be better) coats of paint—there would be fewer complaints of leaky glazing and of putties stripping. A method employed in a limited degree—principally by market gardeners, who use a great deal

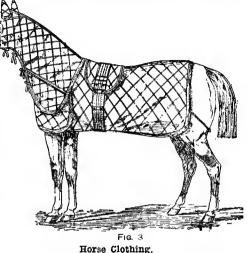
one of which is fixed and the other movable from outside the cylinder by suitable mechanism connected with the engine. The electric current from the battery and spark coil flows through these two contacts when they are pressed together, but when they are suddenly separated the current is broken with the production of the igniting spark. The jump-spark method employs two fixed contacts within the cylinder, permanently separated by a short distance. When a high-tension current is supplied from the battery and induction coil a spark leaps between the two contacts and the charge is fired.

Weight of Building Materials.—A bushel of chalk lime (dry) weighs 50 lb., and a bushel of stone lime (dry) 56 lb. A measure is 1 cub. yd., and contains eighteen heaped bushels, or twenty-three striked bushels; from this the weights can be calculated. A bushel of Portland cement (dry) weighs from 110 lb. to 116 lb. A bushel of hair for plaster, 14 lb. to 15 lb. A load or cubic yard of sand, 26 cwt. to 28½ cwt.; the same quantity of building mortrar mixed (semi-dry), 24 cwt. to 26 cwt. A load of 500 bricks, 9 in. by 4½ in. by 2½ in., weighs about 32½ cwt., and a load of 1,000 plain tiles, 10½ in. by 6½ in. by §½ in., weighs about 23 cwt.

Primitive Methods of Pottery Manufacture.—In the American backwoods, small farmers in their spare time produce pottery ware for local use. The potter, having previously tempered his clay from the clay pit, divides it into lumps of the proper weight for certain size jugs. He puts a lump on the centre of a roughly rigged up revolving dise and proceeds to give it form and shape, mainly with his fingers, sometimes assisted by some simple tool of wood or bone. First he inserts one or two fingers of one hand into the centre of the revolving lump, and presses on the outside with the other hand, and so produces a hole in the clay by sincply moving the fingers to one side of the centre. The clay is now in the form of a thick ring, and is made thinner and drawn upwards to form the side walls of the jug by simply raising both hands at the same time, pulling the clay up between them. The clay now is in the form of a cylinder or wide-mouthed jar, and to make this into a jug the upper rim is forced or bent inward with the hands into the form of a dome, while the neck and lip are shaped with one finger inside the orifice and a stick on the outside. The revolving mass

right across the eyes, cut the hood under the neck all round the throat and down under the head, so that the two sides meet right in the centre. To join and bind them, whip-stitch the two parts of the sheet together along the back, and then put a piece across underneath the shoulder to come down on each side about 1 ft.; let it be pointed at the ends, the width in the middle being about 9 in. and all in one piece to strengthen the point at the shoulder. The padcioth is cut in one piece, but the pieces of hogskin must be stitched in neatly, having been previously pasted on and dried. The breast cloth is cut in one piece, but the hood is in two pieces, and sometimes in four, as pieces are put on the side flaps to increase the size at the sides. Whip the edges together level along the top of the neck and over the head, down the front of the face. If a piece is placed enywhere else, let it be joined in the same manuer, and always bind the joint, stitching it on both sides; cloth, patent, or Newmarket binding can be employed for binding. To bind the breastichh, padcloth, and thood along the edges, cut the cloth 1½ in. wide, and turn it round the edges just sufficiently to catch the first row of stitching about ½ in. from the edge. Now along the inner edge of all parts of the binding. When it puckers too much at a sharp turn, as at the throat of the hood, the puckers can be cut out and then stitched





of soft material responds readily to every touch of the fingers, bending this way or that, but the speed of the wheel must be comparatively slow, otherwise centrifugal force would throw the walls outward and spoil the shape. If the jug is to have a handle, this is moulded separately with the hands and bent into shape, the ends being pressed into good contact with the moist clay jug. The jug is loosened by drawing a fine wire between it and the disc. After being properly dried, it is baked inside a long arch or oven of brickwork having a chimney at one end, the wood fuel being fed into the other. In the arch at intervals are loose bricks, which may be removed during the firing for the purpose of throwing in salt to produce a glaze on the surface of the ware. Some skill or experience is necessary to conduct the firing properly, the pottery being spoiled easily.

properly, the pottery being spoiled easily.

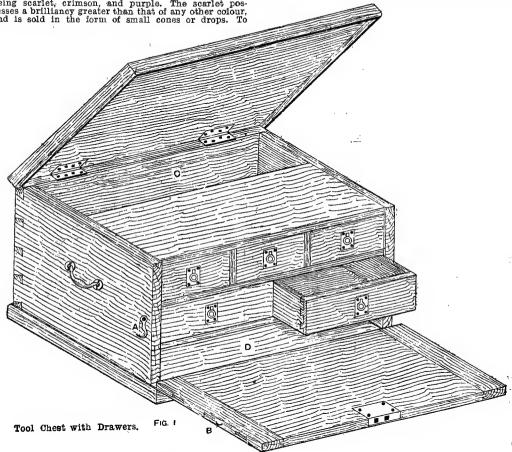
Horse's Padcloth and Hood.—The horse padcloth (Fig. 1) goes under the body roller, about 1 it. 3 in. by 1 it. After rounding the corners of the material, neatly stitch on the inside, straight with the edges, a piece of hogskin, of a wavy pattern and about 2 in. wide. Put one piece at each end in the centre, 7 in. long, and one on each side of the centre. A hood (Fig. 2) must be cut to the shape of the horse's neck and head, from a point about 54 in. below the eye on the nose, then along the ridge of the head and neck to the shoulder, where it should cover the front of the sheet well. Cut the holes for the ears, and make covers for them, the front part being about 1 in. larger than the face of the ear all around, and the back part large enough to pass round the back of the ear, and allow it to enter easily. Stitch the edges, whipping them together; stitch also at the bottom round the hole, all the stitches being on the outside. Take care to put the front cut of the cloth opposite the front of the ear. Having made two holes

edge to edge. A strip of cloth about 1 in. wide must be put across the centre of the padcloth, the ends passing under the loogskip piece and binding. Then add another strip along the centre of the sheet where it joins, and another along the joint on the top of the neck of the hood, the ends being always placed under the binding. Now place fiat strips, \(\frac{1}{2} \) in. wide, along the joints at the side and the points of the ear-pieces, then round the bottom to cover the ends and the joint. This work can be done by machine. The only difference in a Newmarket sheet is that it is cut on a curve from the shoulder to the front at the centre of the chest where both sides meet; there is no breastcloth, the two sides being united by a strap and buckle. The last-mentioned must be on the near side, and the shape like that for a saddle girth. Line the shoulder and the corners of the chest where the straps are stitched with a piece of ruggling underneath. The hood is fastened under the jaw with a small strap and buckle; cadez strings are run from this point to about half down the neck on each side to tie together. The sheets can be bound in two colours, if preferred, or with patent bindings, one colour along the edge and the other by its side. Snpposing red cloth is employed for binding, bind it in all along and then put blue cloth, about \(\frac{2}{2} \) in. wide, just to cover the edge of the red binding. Catch them both under the stich with the first row of stitching, and finish the upper edge of the binding in the same style. Princess check of various colours is fine worsted material, very light in weight, and of very showy appearance. It can be bound with fine worsted binding of one or more colours. When conting the sheet for either of the above, the back should not be made quite straight, but should be scooped ont a little behind the shoulder towards the loin; leave it full at the rump and slanting a little at the end. Fig. \(\frac{3}{2} \) illnstrates the borse covered.

Colours used in Book-edge Marbling,—Generally, the marbling colours are the same as those used for painting, both in oil and distemper. They should be procured in the dry state and ground by the marbler himself, although colours are to he had ground and ready for use and put up in atright jars. Following is a list of colours: Reds—drop lake, peach-wood lake, vermilton, rose plnk, and burnt Oxford ochre. Yellows—lemon chrome, Dutch pink, and raw Oxford ochre. Brown—Turkey (burnt) umher. Blues—indigo, Chinese blue, ultramarine, and Prussian blue. Blacks—Vegetable lampblack and drop ivory black. Orange—orange lead and orange chrome. Whites—China clay, pipeclay, flake white, and Paris white. Drop lake is the most beautiful and expensive of the reds, the different shades being scarlet, crimson, and purple. The scarlet possesses a brilliancy greater than that of any other colour, and is sold in the form of small cones or drops. To

weight of indigo; it is much used. Orange lead, a very heavy colour, is but little used except for the edges of account books. White is not much required, as with gall and water white spots can easily be produced; however, China clay and pipeclay are used where necessary.

Tool Chest with Drawers.—For a tool chest, a handy size is 1 ft. 9 in. by 1 ft. 2 in. by 1 ft. deep. The sides, ends, bottom, and top should be formed of red deal finishing about \$\frac{1}{2}\$ in. thick, the divisions of \$\frac{1}{2}\$-in. stuff, the drawer fronts of \$\frac{2}{3}\$-in. stuff, and the sides, backs, and bottoms of the drawers of \$\frac{2}{3}\$-in. stuff. Of course, these dimensions may be varied to meet requirements. Fig. 1 shows the front hinges on the bottom so as to

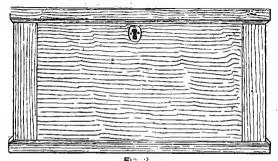


select a good quality, break one of the little drops and try the broken part on the tongue. If it takes up the moisture from the tongue without any inclination to adhere it may be purchased. Vermilion is very heavy, and is seldom used except in combination with some other colour. Rose pink, a very useful colour, is chalk or whiting covered with Brazil wood; it is a fugitive colour, quickly fading on exposure to heat or even to the atmosphere, but with Chinese blue or indigo it makes a good purple. Burnt ochre is extensively used either by itself or in combination with other colours; mixed with black it makes a good brown, and with blues various shades of olive can be obtained. Wood lake is a damp colour and can be used without grinding, being made almost exclusively for marbling. It is the best red for general purposes, and has an appearance almost equal to drop lake. The most useful blue is indigo. It is not by any means a bright colour, but if of the best quality it is one of the most durable. It is invaluable for producing greens and purples. Chinese blue is a necessary colour, but it is not very durable. It must be well ground, and with the addition of varying proportions of white nearly every shade of blue can be produced. Vegetable black will not produce a black for marking except in combination with double its

drop down and allow of ready access to the drawers. To keep the front from twisting and warping, it will require clamping as shown, and when the front is closed up, it is secured to the lid by a lock (see Fig. 2). In addition, a hook A (Figs. 1 and 5) and eye B (Fig. 5) may be used. The bottom is finished off with a plinth which, if rebated as illustrated in the section (Fig. 4), will have extra strength. The lid should be stiftened by a 1½-in. by ½-in. rim. The well c and the space n under the drawers will be found very useful for large tools, etc.

Notes on Gold Mining.—The gold found in gravel is secured by what is called placer mining, and is sometimes called "placer gold." The gravel frequently forms the bed of streams which have become dry, and holds the metal in the form of scales, dust, and fine nuggets. Many of the rivers became dry centuries ago, and their beds have been filled with deposits of earth, and rock, sometimes 100 ft. deep or more. To extract the gravel, the miners dig into the side of the hill, and try to follow up the dry bed of the stream under the mass of earth and rock. These deposits are sometimes called leads by the miners, who try to trace their direction or drift to avoid the removal of extra material.

A large amount of metal is also yearly extracted from the beds of running streams, especially on the Pacific coast and in Australia, this being called alluvial gold; it is secured by washing the sand and gravel which holds it. Hydraulic mining is another method of extracting the gold from the gravel and sand deposits. Water from a reservoir or some other source is thrown through a line of hose against the bank with such force that the embankment becomes loosened and falls into a trough or sluice, along which it passes, the metal it contains being gradually separated from it by the action of the current of water. By this process hundreds of tons of gold-bearing material can be treated in a day. Vein-mining is the term applied to the extraction of the gold found in rocks, which are so hard that water has very little effect on them. Consequently they are dug out with pick and shovel and sometimes blasted with explosives, as in coal mining, the ore then going to the smelter or reduction plant, where it is usually roasted by being placed in a receptacle and treated to intense heat; this allows the rock to be easily broken, and it is then conveyed to the stamping mill. The modern plant of this kind is located near the roasting furnace, so that the ore can be taken to it at once. Here it passes between sets of steel rollers of various sizes, which crushit until it finally comes out in the form of a powder. This is conveyed over plates or troughs containing mereury, which has an attraction for the gold, and catches it or picks it up as it moves over the plates. The powdered rock and other foreign substances are "tailings." Sometimes these are again treated, as they contain a small amount of metal which escapes the mercury in the trough. The cilorination process can be used for extracting the gold from very poor ores, or low-grade ores, as they are sometimes termed, and has rendered



Tool Chest.

many deposits, hitherto considered valueless, of commercial value. In the United States and in England attempts have been made to secure the small percentage of gold in solution in sea water, but thus far the experiments have not been sufficiently successful to carry this on as a business. The general plan followed has been to decompose the water by chemical action, thus securing the metal.

Leather Cements.—(a) Dissoive guttapercha in bisulphate of carbon until of the consistency of treacle. Shave well the parts to be cemented and then apply a little cement evenly to them. Warm them for about half a minute, apply one against the other quickly, and press hard. Keep the bottle well corked and in a cool place. (b) Melt guttapercha, 16 parts; gum rubber, 4 parts; yellow pitch, 2 parts; ahellac, 1 part; and lineed oil, 2 parts, and apply as above. (c) Guttapercha, 1b.; indiarubber, 4 oz.; pitch, 1 oz.; shellac, 1 oz.; and linseed oil, 2 oz. Melt all together. The composition will harden when kept, and must be melted for use.

Bronzing for Leather.—To bronze leather, a small amount of so-called insolvible antiline violet is dissolved in a little water and the solution brushed over the article; it will dry quickly. If the result is not satisfactory, repeat the process.

Fixing Smoke Pictures.—A satisfactory method of fixing smoke pictures has yet to be discovered. Possibly the best fixing solution is rice water or a weak and warm solution of starch, which should be sprayed over the surface of the picture. A scent diffuser may be used, or the very inexpensive piece of apparatus that is sold for fixing chalk drawings. This apparatus consists merely of a piece of brass tubing which sinks into the solution, a stream of air blown over the tube causing a fine spray to be distributed. When this solution is dry it binds the particles of carbon

to the glass and still preserves the matt surface; varnish or gum instead of starch would, of course, give a polished surface. The most satisfactory way of preserving the picture would be to dispense with the fixing, and, instead, glue a neat strip of thin card around the edge of the glass (smoked face), lay a sheet of transparent glass on the smoked surface, and bind up the two glasses together like a lantern slide.

Bonding Chimney Shafts.—There is no standard bond for tail ohimney shafts; they are built in English, Flemish, or mixed hond, sometimes with an excess of stretchers, and at other times with an excess of headers, according to the individual fancy. One course of headers to four courses of stretchers makes a good and suitable bond for circular shafts. Where a difficulty is found in laying common headers, compass bricks, or bricks tapering in plan, are sometimes made for the headers, to facilitate the laying, and to produce close joints. Square shafts may be built in either English or Flemish bond without difficulty.

Mending Spont of China Teapot.—A good cement with which to tasten the broken spout of a china teapot is prepared and applied as follows: Take about 1 oz.

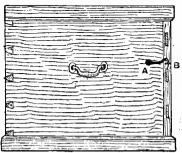
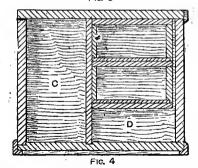


Fig. 3



of gelatine, place it in a wide-mouthed bottle, and cover with strong acetic acid. Next day melt the mass by placing the bottle in hot water, and add sufficient cobalt bine to obtain the desired tint. Warm the portions to be cemented, apply the cement to the broken edges, then press them together and bind the spont on with string. In two or three days the cement will be hard, and the string may then be removed.

Preventing Machinery Rusting.—To keep machinery from rusting, a camphor compound is made with 1 oz. of camphor dissolved in 1 lb. of melted lard; the scum is taken off, and as much fine blacklead is mixed in as will give it an iron colour. Clean the machinery and smear it with this mixture. After twenty-four hours rub clean with a soft linen rag.

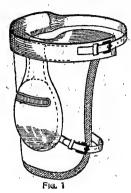
Pasting Selvedges of Typewriter Ribbons.—The selvedges of typewriter ribbons may be pasted down by dipping the ribbon in strong starch paste, folding over, and then ironing with a hot iron while the ribbon is still wet.

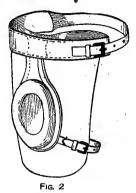
Sponge Lead.—Sponge lead is produced ordinarily from litharge by placing it in contact with a sheet-lead cathode in an electrolytic cell having a lead snode and dilute sulphuric acid as the electrolyte. The deposited hydrogen reduces the litharge, leaving a lead sponge of fine quality. Another way is to subject galena (lead ore) to electrolysis.

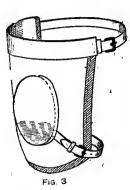
Horse's Knee-caps.—Horse knee-caps (Figs. 1 to 5) are of feit, fawn rugging, kersey cloth, union, buff leather, black rubber, etc. They can be made as follows: When there is no press available, damp some half-curried leather, and beat it as a shoemaker does boot-soles until it acquires the hollow cup shape. After it has had time to dry, cut it to a wide oval shape, about 5 in. by 4 in., and make the cloth, kersey, or leather about 8 in. at the top and 9 in. deep. Round the bottom part, and bind all except the straight top with cadez patent binding or cloth; the buff need not be bound. Then, on the centre, place the leather block, with a piece of shaped cardboard underneath, pasting the two together, and pressing down the cloth to the hollow; then stitch the blocked leather to the cloth, about 1½ in. from the top and 1½ in. from the bottom, and cut a piece of leather 1½ in. wide and 1 in. longer at each end in from the point for a \$in. strap, placing a chape, buckle, and loop in the hole at one end, and a strap of similar width, and 9 in. long, in the other hole, and stitching them both firmly. If preferred, a small square can be placed in the strap side, with a chape to fasten in the hole, a second square heing used for fastening the strap, with an indiarubber ring \$in. wide between the two squares. A piece of chamois leather will be needed to make a roll at the top of the same length and width as the strap, the chamois leather being stripped all along through the top leather and the cloth. The chamois must hang down in front of the knee-cap while this is being done, the three edges being placed to gether; thus, they can be stitched, the top leather reaching to the same distance over each end. Turn the

of the oil, the rise in pressure also being more gradual. Thus a more equal turning moment is obtained on the crank-shaft. The trouble of starting a Diesel engine would be greater than with an ordinary motor, owing to the greater compression required, were not a special device employed. Whilst the engine is at regular work, a certain amount of compressed air is admitted to a reservoir and stored there. When starting the engine, this compressed air is admitted to the cylinder and motion is set up, just as it would be with an ordinary steam engine; after a few revolutions the air supply is shut off and the engine begins its regular work.

Westinghouse and Vacuum Brakes.—The Westinghouse automatic brake works by means of compressed air. An air-jump on the engine forces air into a reservoir underneath, known as the main reservoir. From this a l-in, iron pipe, connected between the carriages with rubber hose pipes, extends the whole length of the train. Under each vehicle is placed a triple valve, an auxillary reservoir, and a brake cylinder. The compressed air fills the pipe, and passes through the triple valves air to each vehicle is placed a triple valve, and to the driver allows the air to escape from the pipe, when the triple valve automatically cuts off the connection between the pipe and auxillary reservoir, and allows the compressed air in the latter to pass into the brake cylinder, the piston of which, through a system of levers, applies the brake. The automatic vacuum brake works by producing a vacuum in a 23-in, pipe, running the whole length of the train, and connected with rubber hose pipes between the vehicles and in cylinders underneath each vehicle. The







Horse's Knee-caps.

chamois leather over the top towards the bottom, and stitch it along the bottom side of the top atrap through cloth and strap, leaving it rather slack. Then make two rows of stitches across in the centre, leaving an opening of about 1½ in. exactly in the centre between the two cross lines. After stuffing the two parts of the roll from each end with flock, close the ends by stitching the chamois and top leather together. Next put a ½-in. chape buckle and loop at the bottom of the block pad, making them slant downwards slightly, with a strap 10 in. long at the opposite side for fastening. The buckles must be reversed when making a pair, each buckle being on the outside. Sometimes the hest kneedaps have the knee block cut with a plece to come from the top to catch the top strap, and be stitched under it, and this is a great improvement, even when there is a separate piece of leather.

Diesel Oil Engine.—In the ordinary form of gas or oil engine the charge is compressed (before ignition) to a pressure varying from 40 lb. to 80 lb. per square inch, and even more, and high compression leads to greater economy, though it is attended with many difficulties, especially in large engines; for one thing, the compression increases the temperature very much, and this might ignite the charge at the wrong moment. Diesel overcomes this difficulty by compressing air alone in the engine cylinder to a pressure of 500 lb. per square inch; in a pump separate from and worked by the engine is a second charge of air, not so highly compressed as the first, and this is employed to treat a certain amount of oil, pass it through a number of small holes, and force it into the engine cylinder in the form of fine spray; the heat evolved by compressing the cylinder charge oauses the mixture to ignite, and whereas in the ordinary engine the fiame, tube, or spark ignition causes a sudden and violent explosion, the Diesel automatic ignition is a more gradual burning

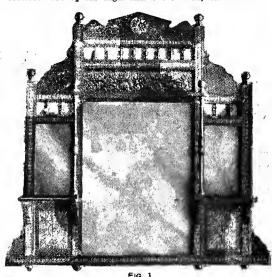
vacuum is produced by means of an ejector on the engine, which consists of two pipes, one inside the other. When steam is forced between the two pipes to blow off at the end, air is sucked out of the inside pipe. In the cylinders the air is exhausted, both above and below the piston. To apply the brakes, air is admitted to the pipes, when a small ball valve closes the opening to the top of the piston, and the pressure on the bottom of the piston causes it to rise and apply the brake. Both these brakes are automatic, and any leakage in the pipes through breaking of couplings would apply the brakes. The simple vacuum brake that would not operate automatically in case of accidental uncoupling of the carriages is now obsolete.

Iron Liquor for Dyeing.—Two recipes for iron liquors to be used by saddlers are as follows: (a) Green copperas, 2 lb.; vinegar, 2 ql.; pulverised nutgall, 1 lb.; and water, 4 ql. Two weeks after mixing add another 2 qt. of water. (b) Bichromate of potash, 1 lb.; logwood extract, 1 lb.; copperas, 1 oz.; and water, 1 gal.

Stain for Riding Saddles, etc.—A stain for riding saddles, etc.,may be made from saffron, three pennyworth; annatto, one pennyworth; soft soap, one pennyworth; and boiling water, 1 qt. Mix and let the whole stand until ready.

Water-colour Paint.—To prepare a cheap water-colour paint suitable for the wood and metalwork of machinery, procure 41h. of zinc white dry, 41h. of powdered whiting, 21h. of brown dextrin, ½1h. of alum, ½1h. of lampblack, and 2 oz. of lime blue. After mixing these ingredients in the dry state, pass through a sieve; the preparation is then ready for use by simply mixing with cold water. The above will give a slate colour. For terra-cotta, omit the lampblack and blue and use 11h. of dry hunt siens. of dry burnt sienna.

Overmantel made from Prepared Moulding.—The overmantel illustrated by Fig. 1 is made entirely of wainut, the outside measurements being 3 ft. 6 in. by 3 ft. 6 in. The stiles and rails are of picture moulding 1½ in. by 1 in., which can be obtained ready prepared; 24 ft. of moulding will be required. This must be ploughed for a groove § in. wide and § in. deep for the inlaid pressed moulding, which is § in. wide, but which must be reduced to fit in the groove. The frame should be fitted together before the inlaid moulding is inserted. This can be done by halving and screwing at the back. The insertion moulding in the rails should be cut and joined so that the pattern runs to the centre. The large glass is 2 it. high and 1 ft. 6 in. wide, bevelled for § in., and the side glasses are 11 in. high and 6 in. wide. The two bottom panels are of pressed walnut, 8 in. by 6 in., and fit in the rebate of the stiles and rails. The panel above the centre glass is I ft. 6 in. long and 4½ in. wide. It is of pressed moulding, but the pattern must just cut in to look well. The stiles extend above the top rail for 2 in., and the pediment is fixed at the back into the rebate with screws. The side brackets are also screwed from the back into the rebate. Patterns for the pediment and brackets are shown in Figs. 2 and 3 respectively, and should be cut out of ½-in. walnut. The side brackets are 7½ in. high and 6 in. wide, the bottom

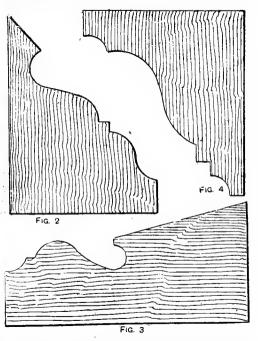


Overmantel made from Moulding.

brackets being 4 in. high and 3 in. wide, the two bottom shelves are 9 in. long, 4 in. wide, and ½ in. thick, and can be screwed from the back to the centre of the rail. They are supported by brackets, the pattern for each is shown in Fig. 4. These are also screwed from the back. The corners of all the shelves should be rounded off. The top shelf is 1 it. 9 in. long, and of the same width and thickness as the shelves at the bottom. It is screwed from the back into the edge of the chelf, and is supported by two turned pillars, which are 1 it. 33 in. long, and have a turned dowel on each end with a turned finial fixed above the shelf. The finial and the apindles are 2 in. high.

Remoulding Phonograph Records. — For this all that is requisite is a suitably constructed mould in which the wax may be recast. For this purpose, a sound cylinder, which has been "shaved" quite smooth, should be taken, and the internal spiral projections scraped off flush, with the surface by means of an ordinary table-knife or other long-bladed instrument. The surfaces, both internal and external, should then be completely covered with a thin layer of bronze-dust or other metallic powder, so as to render it a good conductor of electricity, and this is most readily done by mixing the powder into a paste with ordinary benzine and painting it on with a brush. The benzine softens the surface of the wax, dissolving it, and as it evaporates ementing the bronze particles in position. Leave the thicker end or edge uncovered, and see that every other portion is entirely coated. This done, the entire surface should be rubbed down or burnished with a bone handle or other instrument. A piece of stout copper wire, about 6 in. long, should be bent into a

half hoop and its ends fixed to the cylinder by warming them, and pressing into the uncovered end. This wire should then be put into metallic communication with both inner and outer bronze coverings by painting a streak of the bronze mixture round each end of the wire where it enters the wax, and down the inside and outside of the cylinder. The prepared cylinder should now be suspended in a sulphate copper depositing or electrotyping bath, and copper should be deposited over the metallised surfaces to a thickness of about ½ in. The eurrent from two quart Bunsen batteries, connected in parallel, will be sufficient, the plating bath consisting of a saturated solution of sulphate of copper containing 5 per cent. of oil of vitriol. In addition, the following precautions should be observed. An internal as well as an external anode should be used, the latter being made of thin sheet copper rolled into a fairly large cylinder. The internal anode may be of copper rod, in. in diameter, or sheet copper rolled so as to give the same surface. The copper will be deposited more evenly, and an increasing current may be employed, if the cylinder is rotated during the operation. This may be done by suspending it by the copper hoop from a long spiral of

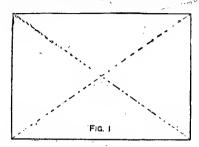


stout copper wire provided with a projecting piece of wood, which may be moved round alternately from right to left and vice versā, thus giving the cylinder a semi-rotary movement. The carbon terminals of the battery are connected to the two copper anodes, and the zinc terminals to the spring supporting the cylinder. The deposited copper should be salmon-pink in colour. When the deposition is complete, the cylinder should be removed from the bath, washed well with cold water, and dried. The wax core may then be removed by gently heating the copper covering in a Bunsen burner while held upside down, this operation being similar to taht by which the subsequently recast cylinders will be extracted from the mould. Leaving the thicker end of the cylinder uncovered, the conical mould with its smaller diameter would be uppermost and open, and thus the extraction of the cylinder is rendered easy. The operation of removing the wax cylinder is also facilitated by grasping the copper wire hoop, and using it as a handle to rotate the cylinder and screw it out, the copper being meanwhile warmed gently by a Bunsen burner. For casting the cylinders, the broken pieces of wax must be melted in an iron saucepan or ladle; about 3 oz, will be required for each cylinder. Stir carefully during the melting, and skim off any dross or scum that rises to the surface. The copper mould, previously cleaned with a piece of rag dipped in turpentine or benzine, must be neated to the melting point of the wax, and the melted composition carefully poured in so as rather to overfill the mould. When quite cold, the wax cylinder may be removed as described above, and may then be put on the phonograph and shaved as usual.

Metal Pulverisation in the Electric Furnace.—
This has formed the subject of several patents, but still little is known of the practical operation of the methods or of the nature or use of the several products obtained. The general method is simple in the extreme. A metal is heated either by the arc or by the passage of a heavy current through a column of reduced cross section, and is thereby brought to the temperature of volatilisation. Vapours so produced are, in most cases, directly combustible in air, burning freely to oxides, or may be subjected to various reagents with corresponding variety in the products; or, finally, the metal may be collected directly in comminuted—that is, finely divided—form in an inert atmosphere. The applications of the method embrace the manufacture of a whole series of pigments, abrasives, refined metals, and miscellaneous reagents.

Time Required for Seasoning Wood.—The time required for seasoning wood scandings depends very much on the method of seasoning adopted, and upon other circumstances. Laslett gives the following periods for timber properly stacked under cover: 16-in. scantling, hine months; 12-in. scantling, seven months; 8-in. scantling, 5 months; 4-in. scantling, three months. After work for joinery has been planed up, it should be left as long as possible before putting the work together.

Taking Measurements for Carpet-planning.— Carpet-planning is a process that requires careful measurements, as very often the man who takes the draught plan does not also plan and cut the carpets at the cutting-room. The process is as follows:—Supposing that the purchaser has chosen the pattern, before proceeding to the house obtain a plan-book of stout paper about

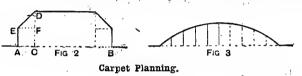


1 ft. 6 in. long by 1 ft. wide; also a 2-ft. rule, a 66-ft. tape measure, and a chalk line, one of the self-chalking variety being the most convenient. Remove as much of the furniture as possible before taking measurements. First take the square plan of the room without taking into account any recesses, windows, etc., and mark down in the plan-book a rectangle, as in Fig. 1, carefully checking each measurement to prevent mistakes. Next take tape measurements from corner to corner; If these are not equal, the room is not square at all the corners. This should, of course, be shown as the result of the first measurements; if not, then they are wrong, and should be corrected. Then fill in the details in the plan-book. For the fireplace have the curb placed in position, unless the hearth is tiled, when measurements should be made close up to the tiled border. Fig. 2. shows the method for a bay window. Spring a chalk line across the opening indicated by the dotted line AB, then plan the line CB, and strike off EF, when the angle can be drawn in. The length of AB can be checked by adding up the distances between the offsets. In planning for circular windows, recesses, etc., it is necessary to take offsets at every foot (see Fig. 3), unless the curve is very quick, when measure at each 6 in. The length and position of each offset should be clearly marked in the plan-book, when the segment can be drawn. Other irregular shapes are planned in a similar manner.

Cutting, Handling, and Hanging Tobacco.—These processes, as carried on in the Connecticut and Housatonic valleys, require the greatest possible care in order that the leaf shall not be broken. The plant has a woody stalk about 1 in. in diameter, and it is out close to the ground by means of a hatchet or saw, and is laid carefully on the ground to wilt; this it does rapidly, and it must not remain very long or it will be burnt by the sun. When wiited sufficiently, it is strung on laths, five or six plants to each lath; a hollow steel needle adjusted to the end of the lath facilitates stringing, the needle being passed through the centre of the stalk near the base. For carting the tobacco from the field to the barn, a high rigging is built and placed upon the framework of a farm wagon. In the barn the tobacco

hangs from a series of horizontal poles placed 4 ft. apart, centre to centre, with a vertical distance of 5 ft. between the tiers. The lath on which the tobacco is strung has its ends resting on these poles, and the laths are 9 in. apart to ensure uniform ventilation and curing, the sheds being so constructed that there is thorough ventilation. The plants hang for about nine weeks before they are cured sufficiently for "stripping," this process consisting of separating the leaves from the stalk. Owing to the leaves being exceedingly brittle, this separation can be done only on warm, damp days, when the leaves are softer, silky, and more pitable. The leaves are placed in hardware baper, and the bases of the leaves are towards the end of the boxes so that the leaves overlap in the centre. They are removed in the paper lining and tied into bundles, in which the leaf may remain in good condition for several months, provided that it was stripped at the proper degree of damp; ness. In this manner it is taken to the warebouse, where it is sorted leaf by leaf according to its quality and grade. There is a great risk of the entire cropbeing destroyed by hallstones, the hallstones tearling the leaf to pieces, either spoiling it entirely or reducing its value.

Harmonising and Contrasting Colours.—When colours are so arranged as to produce a pleasing effect, they are said to harmonise. There are no definite laws for the harmony of colours, but the principle may be accepted that the less colours are chromatically related to each other, the two colours which are chromatically related be placed so that there is an abrupt transition from one to the other, a discordant effect will be produced. We see this in nature, where colours are never allowed to come in contact, but are harmonised either by being separated by neutral colours or by a gradual blending of one into the other. All the primary colours



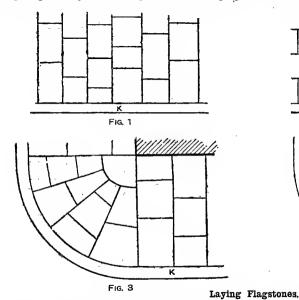
gain in brilliancy and purity in juxtaposition with grey, but the effects are different from those which result from their proximity with white. If two colours go hadly together, it is always advantageous to separate them by white. No assortment of primary colours with black is disagreeable, nor does black produce a bad effect when associated with two bright colours, and consequently it is often preferable to white in an assortment where it separates the colours from each other; for example, in separating yellow and red or yellow and orange. But it does not associate so well if one of the colours is luminous and the other is sombre, such as orange and blue, yellow and blue. If white, when associated with a luminous and a sombre colour, produces too strong a contrast, grey will be more advantageous in contrasting those colours, and it will also be more desirable than black if it be found that black increases the proportion of the sombre colour. For example, grey will go better than black with orange and violet, or with green and blue. It should be remembered that when two colours combine badly, and when, in order to produce an agreeable effect, they are separated by white, or grey, or black, it is essential in selecting the separator, to take into consideration the height of tone of the colours and the proportion of the sombre to the luminous colour. For example, the effect of white with red or orange is too crude, but black will go very well with the normal shades of those colours, and even grey will produce a less crude effect than white. The more colours are opposed to each other, the easier it is to assort them, for they do not experience, when placed together, any change which renders them disagreeable.

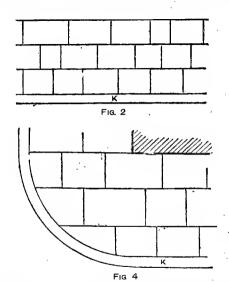
Observatory Roof Construction.—The usual method of constructing an observatory roof is to fix a dome of boiler-plate (with one section made to open) on a set of wheels arranged to run on a circular rail, so that the opening in the dome may be turned to any quarter of the sky. Where the telescope is fixed on a solid level foundation, some such arrangement is absolutely necessary. Where the instrument is movable, the roof may be formed like that of a greenhouse or of a photographer's studio; and the openings may be formed in any way that will allow every portion of the sky to be seen. It is necessary that there should be openings or that the glass should be movable, for it will be impossible to see the stars with common glass intervening between them and the telescope.

Processes of Galvanising.—The iron articles to be galvanised are dipped in dilute acid—hydrochloric, sulphuric, or nitric. This is done in order to expose a fresh metallic surface, and the resultant diminution of strength is infinitesimal. The usual systems of galvanising consist of dipping the article, after it has been oleaned by dipping in acid as described above, in a bath of molten zinc; or, in some cases, the iron is first tinned by a solution of chloride of tin, and the plate so prepared is passed through molten zinc. By the last method the zinc is deposited in a crystallised condition.

Laying Flagstone Footpaths.—The sizes of the separate flagstones affect the appearance of a footpath, large flags giving a smoother and pleasanter path, but costing more than small ones. The sizes actually in nse vary greatly in different districts; thus, in Bradford, Yorkshire, 3 sq. ft. is the minimum area allowed in any one stone. In Blackburn, 5 sq. ft. is the minimum area. Very often the practice is to specify a certain gauge or width of flag, and then a maximum and minimum length; thus, at Stockton-on-Tees, the gauge may be 2 ft., 2 ft. 6 in., or 3 ft., while the length must not be less than 1 ft. 3 in., and the average length of all the flags not less than 1 ft. 8 in. The usual manner of disposing the flags in the footpath is with the gauge

sides of the saw should always be kept well up to their work to prevent the blade from twisting. The back of the saw should not press against a stationary piece of wood, but should run against a roller or disc, and the saw pulleys should be kept free from sawdust and resin. A stock of saws from ½ in. to 1 in. should be kept, and wide saws should not be forced round sharp curves. The following is a good way of joining band-saws: First clean any dirt off the saw; then take the set-off and splice each end to the length of three teeth; fasten on an iron bracket, wrap small iron binding wire around each end of the splice; cover the joint with spelter or brass wire, which in turn must be covered with wetted borax; then apply the white-hot tongs, and when the blue fiame produced by molten brass is seen, the joint is brazed. To remove any surplus borax, slightly hammer the joint when it is cold. File the saw down to the proper thickness, and set it at the joint; it is then ready for use. The saw should always be made straight on the back edge. When starting a band-saw, it is best to put the belt very gradually on to the fast pulley, as the saw has to drive the top pulley; if this is not done, the saw is very apt to be strained. It is a waste of time to repair band-saws that have been broken several times; the continual bending over the saw pulley crystallises the steel, and if the hlades are closely examined,





or regular width running across the direction of the path, as shown in Fig. 1, but this system is not invariably followed, the gange being sometimes disposed as in Fig. 2. The gauge or width of the courses is generally from 2 ft. to 3 ft. The foundation on which flags are laid consists generally of 3 in. or 4 in. thickness of cinders or gravel, and the flags are bedded solidly on these, driven into place with a heavy mallet, and the joints flushed up with mortar and afterwards pointed. It is important to square the edges of the flags oarefully, so as to make a neat-fitting joint, without undercutting in a fashion that would weaken the flag at the edge. The footpath is laid with a slight fall to the kerb K, so as to clear itself of water, the inclination being usually ½ in. to each foot of width. At corners of streets, in the best work, the flags are radiated in the manner shown in Fig. 3; in commoner work the courses are run through, as shown in Fig. 4.

Care of Band-sawing Machines.—A wide blade bandsaw should not be forced round charp curves; for such work, saws of a sultable width should be used, and good set should be given by an ordinary hand-set. The teeth should be so sharpened as to make a round-bottomed tooth; if sharpened with an ordinary saw file, a sharp angle is made, which is often the beginning of a flaw, and saws always break through at the bottom of the teeth. The blade should be greased when cutting resinous wood like pitchpine, and the saw should be kept very sharp, as extra pressure must be applied to make a duil one cut, thus considerably shortening the life of the saw. The tension of the blade should be relieved when it is not working, and the guides at the

they will show at the bottom of several of the teeth slight flaws that will eventually break through. The only disadvantage pertaining to a band-saw is, that it cannot be used for cutting curved or straight work that has no opening; but such work is seldom required in an ordinary shop, and when it is wanted a fret-saw should be used. Band-saw machines should always have a canting table for sawing bevelled work.

Increasing Adhesive Power of Gum Arabic.—
This may be done by the addition of crystallised aliminium sulphate. For 250 parts by weight of concentrated gum solution (28°5 per cent.), 2 parts of the sulphate dissolved in 20 parts of water would be necessary. The gum is then sultable for unsized paper, pasteboard on pasteboard, wood on wood, glass, porcelain, and other substances to which gum as a rule does not adhere well.

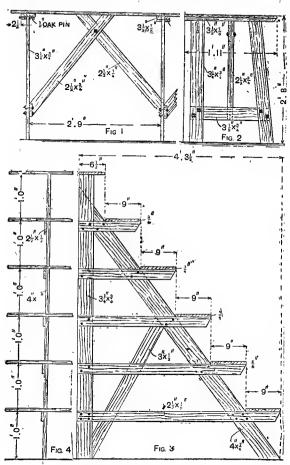
substances to which gum as a rule does not adhere well.

Lining Shaft Tugs.—These have very often to be lined. If possible, use sole leather for the outer piece of lining, and, as the stitches are made coarser than for a new tug, cut a groove in the outer lining all along on both aides, and sink the stitches. Never cut the old lining straight across without thinning the end and that of the new piece for spilcing. It must overlap the old one, not merely meet it end to end. In lining shaft tugs, try to make them level. Sometimes three or four thicknesses of leather will be needed, but the length must be regulated and the ends of every piece shaved, so that, when placed together, they will run down to the thickness of the old parts. Always make the chapes long enough for such things as hearers and breeching straps, etc., shaving the ends to be joined to the chape, and finishing neatly.

· william of the Built

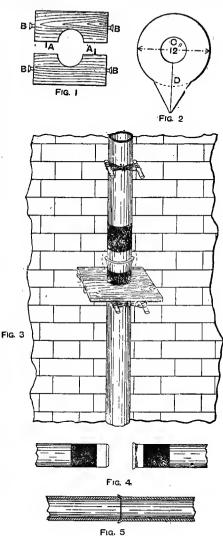
Show Stand and Table.—A portable table or stand for use by a shopkeeper in displaying goods is illustrated in elevation by Figs. 1 and 2; it may be composed of stuff about \(\frac{3}{2}\) in. thick to the dimensions given, the length over all being 12 ft., and the width 1 ft. 11 in., and the height to the table top 2 ft. 8 in. The top, \(\frac{3}{2}\) in. thick, is glued up to the required width, and ledges, spaced as shown in Fig. 1, are screwed to the under side. The ledges and top are mortised to receive the tenons on the ten legs, the mortises being ont a trifle longer on the top side. The legs are set out, all the back ones together, and all the splayed front ones together, and the cross-rails at the bottom are fastened with \(\frac{1}{2}\)-in. boits 2 in. long, and nuts with washers to suit. The top ends of the legs are tenoned, the tenons being set back \(\frac{1}{2}\) in. on each edge. Two \(\frac{1}{2}\)-in, holes are bored as shown in Fig. 2, and a saw-kerf is run down

shelf is housed out 1 in, bare on the under side, and the upright boxes into the same. The 9-in, shelves do not overlap each other, so that a backing of glazed/lining may be tacked along the front edges to screen off the back part, which can be utilized for packing purposes if matchboarding is laid on the bearers. If the back matchboards are slightly nailed or bradded to the bearers, no diagonal bracing will be required to prevent racking of the shelves. These are fastened to the bearers with fine screws, and the standards are nailed to the floor. Both stands can be stained with Bismarck brown dissolved in boiling hot water if appearance is to be studied. to be studied.



Show Stand and Table.

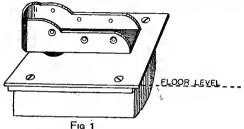
the centre into the lower hole; then a \$\frac{1}{2}\$-in. pin, tapering to \$\frac{1}{2}\$ in. full in the length, is driven through half-way into the first hole, thus, tightening up the tenon securely. The braces are belted together at the top, and the bottom ends should be bird's-monthed at about the centre of the cross-rail, and are well screwed to the same, and also into the table top on the under side. This table, if properly made, is very rigid, and, being light, can be easily moved even when loaded. The tier of shelves shown in side elevation by Fig. 3 are 9 ft. long over all, 6 ft. 0\frac{1}{2}\$ in., high to the top, and project a distance of 4 ft. 3\frac{1}{2}\$ in. The four standards are of \$\frac{3}{4}\$-in. stuff, of the dimensions shown, and the slant piece at the front is half dovetail-lapped to the back upright, and well screwed with five \$1\frac{1}{2}\$-in. No. 12 screws. The cross bearers are of \$\frac{1}{2}\$-in. stuff screwed as shown, the bottom ones having four screws at each end; Fig. 4 shows the method. The brace is screwed to the bearers, and should be housed a short distance into the back of the slant piece, and be well screwed at the foot of the upright. The top



Plumber's Upright Joint.

Wiping Plumber's Upright Joint.—An upright is one of the simplest joints a plumber has to make, but it requires not only the skill in manipulation that can only be obtained by practice, but also patient attention to detail. The joint about to be described is made on a piece of 4-in. soil pipe, though joints of any size, from ½ in. up to 6 in. or mere, can be made by the same method. Begin by straightening the pipes and squaring up the ends. Then open one end of the pipe with a turn-pin (or tan-pin, as it is sometimes called), rasp of the arrises of both pipes, and see that the bore of each pipe is free from burr. The pipes should be solded for about 6 in., leaving a clean sharp edge, which may be obtained by carefully wrapping a piece of straightedged paper round the pipe, and allowing the soil to

overlap the paper; when the soil is dry, the paper can be removed. With a pair of compasses set at 2 in., or with a scribing gauge, scribe round the spigot pipe, and with the compasses set at 1½ in. scribe the socket pipe. This will allow ½ in. of one pipe to enter the other, and give a 3½-in. joint, which is the proper size for a 4 in. pipe. Carefully shave every part of the pipe between the scribed lines and the end, using only enough pressure to remove a very thin shaving; if any part of the pipe is left unshaved, the solder will not adhere to tit; and if too much pressure is used, the pipe will be weakened at the junction of the solling and the shaving. To keep the air from tarnishing it, and to act as a flux, rub a tallow candle (or, as it is sometimes called, a touch) over the shaved part. The pipe can now be fixed ready for wiping. To catch the wasted metal when wiping the joint, a platform or collar will be required. To make it, procure two pieces of ½-in. floor-board 1 ft. long, place them side by side, and having found the centre describe on the boards a circle, of 4½ in. in diameter, in such a way that there shall be half a circle on each board. These half-circles should be cut out with a pad saw, and provision should be made for pinning the boards together, as shown at A in Fig. 1. Four screws should be inserted, as at BBB, for holding the edges of the boards together with string. The boards should be soiled all over, and they can, of course, be used again and again. An alternative method of, making a collar is shown in Fig. 2, which represents a plece of sheet lead containing a circle 1 ft. in diameter and a projecting thone, c being the 4½-in. opening, and the line D showing where the lead has been cut for convenience in encircling the pipe. Fig. 3 shows the boards in position; the lead collar is applied in the same manner. Fasten the pipes against the wall by tying them



Hingeing Swing Door.

to spikes driven into the joints of the brickwork (Fig. 3). Fig. 4 shows the pipes ready for fitting; care should be taken to ensure perfect contact, otherwise the solder will run down and form tear-drops inside the pipe. A section of the joint when made is shown in Fig. 5. Great care is necessary in melting the metal; it is hot enough when a piece of paper dipped into it bursts into flame. If allowed to get red hot, the solder deteriorates. The soldering-iron also should be heated to the proper temperature, and the point filed clean and bright. When the preparations already described have been made, the solder melted, and the iron made hot, the joint should be splashed with the molten metal, by the aid of the splash-stick, until the pipe is hot enough and sufficient metal has accumulated on it for the cloth to be used; in judging the right temperature, experience is the surest guide. Begin at the top of the joint, and with the hot iron in one hand, and the cloth, which should be previously warmed, in the other, rub the iron over the metal on the joint and wipe round with the cloth quickly and lightly, working downwards until the joint is finished. Quickness and dexterity in using the cloth and the iron are the essentials of joint-wiping, and no amount of theoretical knowledge will compensate for their absence. The cloth used for the above joint should be folded to six thicknesses, and should measure, when folded, about 4½ in. square. Wipe the edges clean when the joint has partially cooled, it may be cleaned and brightened by rubbing it over with tallow and wiping off with a clean soft rag. The joint will crack and sweat if it is knocked before the solder has set; the final operations, therefore, of removing the colar and re-solling the pipe to show up the joint, should be carefully performed.

Plumber's Temporary Workshop.—Supposing that

Plumber's Temporary Workshop.—Supposing that a plumber is sent to a country joh, and has to fit up a shop to work in, the plant and tools he requires (assuming the work to be all internal plumbing) may be thus summarised:—For the shop: Door with lock and key; fireplace with water safe or fender; bench and trestles; quench pall, quench hook, and rubber; solder pot, pot hook, and dross box; plumbers' irons and large ladle; broom and shovel; long and short bending dummies;

box and sand for small lead castings; cupboard for brasswork and small fittings; large cupboard for earthenware goods; tool box. Plumbers' tools: Mandrils for all sizes of pipes; large and small hammers; chisels; fixing points; string; hornbeam and box dressers; bending sticks; mallets; rasp; tanpins of all sizes, from in. to 5 in.; hand dummies; bending bolts of all sizes; rule; drawing and chipping knives; shavehooks of all kinds; wiping cloths and felts; 3-lb, 4-lb, and 6-lb, ladles; cutting pliers; pincers; screw wrench; hand shears; long and short screwdrivers; saw; copper-hit for tinning brasswork; chalk line and chalk; soil and pot and tool and caulking tools for iron socket pipes.

Repairing Surcingles and Saddle Girths.—These often break in the centre; to repair them stitch the ends together, and make a basil cover tight enough to pass round them, stitching each side, and then put it over the end of the girth, making four or more rows of stitching elements. ing along it.

Forming Heel and Fixing Hinges to Swing Door.— In preparing the back edge of a door for a spring, the shape, if a stock pattern, should first be obtained from the makers; but the shape, if special, should be sent

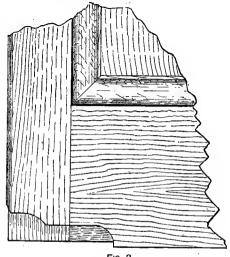


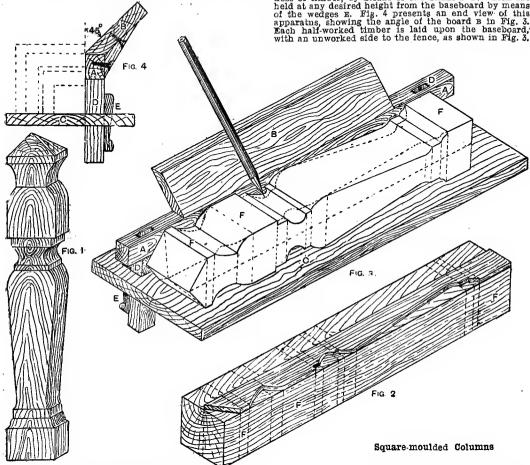
Fig. 2

with the order, when the heel (Fig. 1) will be made to suit. The spring should be kept level with the floor or the step, as the case requires (see illustration), and the thickness of the plate let in on either side (see Fig. 2).

Wood-preserving Processes.—Bethell's process, also known as creosoting, consists in placing pieces of seasoned timber in closed wrought-iron cylinders, from which, and also from the pores of wood, the air is extracted. Oil-of-tar, known as creosote, is then forced into the cylinders and pores of the wood, at a temperature of about 120°, and under a pressure of 60 lb. to 170 lb. per square inch, according to the porosity of the wood and the purpose for which it is required. The quantity forced into the wood varies from 3 lb. per cubic foot in some hard woods to 12 lb. in soft woods. Bouchere's process consists in placing a reservoir, containing 100 parts in weight of water to 1 part of sulphate of copper, in a position about 40 ft. or 50 ft. above the timber, and connecting it by a flexible tube to a cap which is fixed tight to one end of the piece of timber under treatment. The pressure is sufficient for the fluid to force out the sap at the other end and take its place in the pores of the timber. By Burnett's system a fluid is prepared in the proportion of 1 lb. of chloride of zinc to 4 gal. of water. The timber is sometimes laid in a bath of this fluid until it has absorbed sufficient; or the solution is forced under pressure into the timber. The value of the above processes lies in the preservation of the timber from dry and wet rot, and, in the case of the latter two systems, from most insects, so long as the salis remain in the timber; but hy some authorities the salts are said to be gradually removed by the action of water, and thus in time the timber becomes a prey to insects and decay. When, however, timber is treated thoroughly by Bethell's process, its durability is greatly increased, and it is rendered proof against the attacks of every insect, including the white ant.

Working Square-moulded Shafts and Columns by Hand.—Square-moulded shafts or columns for posts, newels, balusters, and pillars in artistic joinery are, when small in section, and when a considerable number of them is required, usually turned in a specially constructed lathe, but where the number required is limited —to a dozen, for instance—it is more economical to do the work by hand. When the section is large, as in newels for stairs, the very obvious curvature of the lathe-turned faces detracts considerably from their beauty, and hence it is often preferable to execute such work by hand on the beach. Fig. 1 is not intended as a model design, but appears for purely descriptive

or by fillets nalled down to the bench, and the ends are all brought fair. The lines are then continued across the whole of the pieces, which, whilst in this position, are sawn, worked down, and brought up to a finely finished face. They are then turned over, still holding them in the cramps, when the opposite face is treated in a similar manner. They are then ready for marking the mitred edge, as shown in Fig. 3, which shows the method of marking the moulded face, and also the appliance for facilitating this process. A fence a carries a board B, pitched to the angle of the mitre, which in this case is 45° × 90° to the baseboard C. The fence a is made to move up and down, so as to suit any thickness of timber, by means of two stalks D D. which are held at any desired height from the baseboard by means of the wedges E. Fig. 4 presents an end view of this apparatins, showing the angle of the board B in Fig. 3. Each half-worked timber is laid upon the baseboard, with an unworked side to the fence, as shown in Fig. 3.

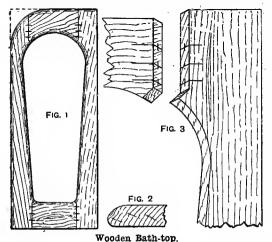


purposes; its members being rendered large and coarse in order to simplify the marks for the mitre in Fig. 3. In beginning the work, the timber must first be planed up straight, and the faces made properly square. The timber need not be square in section, but may be rectangular so long as the faces are at right angles to one another. A half mould or profile is made from J-in. wood to the required design; Fig. 2 shows its application. The straightedge of the profile is laid to the line marked down the centre of one face of the timber to be worked, and the shaped edge is then marked all round for the members to be worked on. The profile inaving been removed, square over the face and edge of each angle, and of the commencement of rounded parts, as shown by the dotted lines in Fig. 2. The profile is then reversed, and the opposite edge of the same face is treated in a similar manner, care being taken that the angles coincide with the lines squared over. When only one example has to be worked, two opposite faces are treated in this manner, but when there are several copies one face of each of two of them is marked in the manner described above, and a practicable number of pieces are then laid side by side between the two marked ones, so that the marks appear on the outside in both cases, and the pieces are fastened together with cramps,

A pencil, having a side planed fiat and straight, is laid evenly on the plane B, as shown in Fig. 3. The fence is then moved up or down, and adjusted so that the point of the pencil coincides with the edge of the unworked squares of the timber, marked F in Figs. 2 snd 3, and fixed in this position by tightening up the wedges E. The pencil is then worked along the plane, with its point in contact with the moulded face, and drawn up or slipped down as occasion requires, until the whole length of the moulded parts being longer than the plane B, the timber must be moved along the board, in contact with the fence, until the whole length has been scribed round with the pencil. After all four angles have been marked in this manner and the members squared over, each timber is worked down singly and brought to a finely finished face, care being taken to work up close to the marked edge, so that on looking at it anglewise the edge shall appear as a straight line. This apparatus is useful for similar work in stone.

Relining and Stuffing Cart-saddle Panels.—Afterremoving the panel from the tree, remove from the back all the old stuff, including the lining and the straw; then remake it just like a new one, and nail it in place. Amount of Driers in Paints.—Driers in paints should not exceed from 3 to 5 per cent. by weight of siccative, and to ascertain the correct proportion the paint should be required to dry hard in twenty-four hours. For lead colours increase the amount of driers, though for redlead do not use any driers at all. For non-tacky coatings on floors, chairs, etc., and for graining grounds, always employ lead colour as the foundation and a lead preparation as the drier, but do not use lead driers in pure zinc-white preparations and in white lacquering.

Wooden Bath-top.—It is important that the projection of a wooden top over the inside of a bath should be equal all round, and to ensure this a rough template should be made by screwing together four pieces of thin board; the exact shape of the opening can then be obtained by laying the template on the bath and marking it round underneath. The board can then be cut away to within § in. of the mark, § in. being the correct distance for the top to project. The template can then be used to mark the material from which the top is to be made. The top is formed of four pieces, secured together by means of dowels, and mitred at the inside as shown by Fig. 1. The stuff is planed up, and the inside curves marked by means of the template and cut to shape. The two end pieces are also cut to shape, both at the ends and at the mitres, and both must be squared from the top. Lay the two side pieces on the template in their correct positions, the end pieces being also in



place; the side pieces can then be marked correctly with a marking-point. The side pieces must be cut away so that the end pieces fit in them. This done, lay the complete top on the template, in order to make certain that it is the right shape. If it is, and all the joints and mitres fit properly, the dowel marks (see Figs. 1 and 3) may be made. One dowel should be placed nearly close to the mitre, and the others about 2½ in. apart; three or four are used at each joint, according to the width. Square the dowel marks over on to the edge of the stuff, and run a gauge mark along to indicate the distance for the dowels from the top. In hering the holes for the dowels, the point of the bit is inserted, in the case of the end pieces, exactly at the point at which the lines cross; in the case of the side pieces it is placed slightly nearer the mitre. This gives the effect of draw-boring, and ensures a close joint at the mitre. All the dowels are put in and the top cramped up, without being glued, in order to see that the work is all correct. If it is, the joints and dowels may be glued with very hot thin glue, and cramped up quickly and left to dry. Unless the bath is in a recess, one corner of the top will have to be rounded off, as shown in Fig. 1. This must be borne in mind when marking for the dowels, as it would spoil the appearance of the top if a dowel were to show through on the front edge. When the glue is dry, the top can be cleaned off, and the opening all round, as well as the front edge and end, worked to the section shown by Fig. 2. If the top has to fit on an old framework, it must be fitted hefore the front and end are finished; but, when the work is all new, the front and end can be finished off, and the back and remaining end left to be fitted after. The framing to which the top is fixed can either be panelled or of tongued and grooved boarding; or, as is sometimes the case, the latter round the curve, and a straight plece of panelling along the front. This makes a poor job at the

best, and there is really not much difficulty in making a circular piece of panelling. Bath tops made from one piece of wood are certain to split at the ends. In an alternative method of constructing a bath top, the mitres are dispensed with; the objection to this method is that the end grain at the corners is liable to break away. Yet another method is to fix the top together by means of mortises and tenons; this, however, is the worst of all methods, besides being the most difficult.

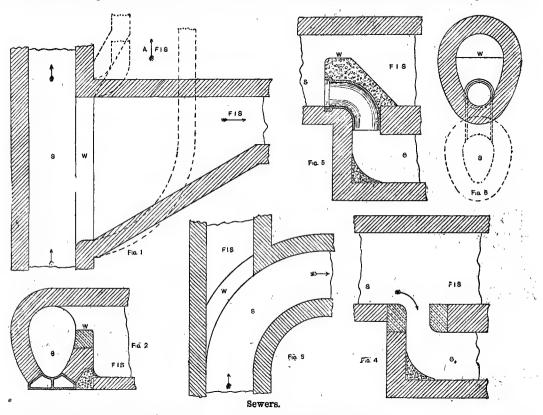
Colours used on Architectural and Mechanical Drawings.—Colour is a very considerable aid to "reading" a drawing, particularly when different materials occur in connection with each other. The colours not only emphasise the separate pieces by contrast, but custom has decided that certain materials shall be represented by certain colours, some being almost the natural tint of the material, and others purely conventional. Among the latter, perhaps the best known is crimson lake to represent section of brickwork. It is more important that parts in section should be coloured than parts in elevation; a section is always an imaginary cut, and the colour is put upon the cut surface hecause otherwise we should not recognise it see easily as we do the elevation. A true section can only be seen by "mental vision," while an elevation is subject to ordinary vision. The accompanying list gives the average practice of the best engineers' and architects' offices. Some of the colours may be replaced by less expensive ones, such as yellow color for Roman ochre, neutral tint for Payne's grey, or neutral tint with a little crimson lake for violet carmine.

| Materials. | Elevation. | Section. |
|-------------------------|---|--------------------------------------|
| Wrought-iron | Prussian blue, very | Prussian blue, dark. |
| Cast-iron | Payne's grey, very | Payne's grey ,, |
| Yellow bass | pale Gambogs | Gamboge ,, |
| Gnn metal | Indian vellow | Indian yellow ,, |
| Steel | Indian yellow Violet carmine, very pals | Violet carmine ,, |
| Lead | Indigo, very pale French blue, very pale | Indigo " |
| Zine | French blue, very pale | French blue " |
| Leather | Burnt umber, very | Burnt umber " |
| Chain | P. ussian blue, dot and stroke | None. |
| Rope | Burnt sienna, det and | None. |
| Copper | Crimson lake and | Crimson lake and |
| 00PF02III | burnt sienna | burnt sienna, dark. |
| Fir and deal (wrought) | Burnt sienna, pale | Burnt sienna, dark rings. |
| Fir and deal | Do. or gambogs | Burnt sienna, |
| (rough) | , | edged round and |
| Oak | Burnt umber, pale | Burnt umber, dark. |
| Brickwork | Roman ochre | Crimson ake ,, |
| Red bricks | Light red ,, | Indian red ,, |
| York and soft | Sepia, very pale | Sepia |
| stone | | |
| Granite and Portland | Indigo ,, | Indigo 99 |
| | | |
| Concrete | None | Payne's grey and selia. |
| Earth | None | Sepia, light and |
| Plaster and ce- ment | Indian ink, pale | Indian ink, dark. |
| Slate | Payne's grey | Payne's grey ,, |
| Line of section | Vermilion or crim- son lake, stroke and | 2,, ,, |
| , | dot. | |
| Mahogany | Light red and burnt | Light red and burnt sienna, dark. |
| Greenheart | Indigo and gamboge | Indigo and gambogs, |
| Old brickwork | Indian ink, pale | Indian ink, dark, |
| Blue bricks | l Indigo and Indian | Indigo. |
| Stone drassings | ink French blue, very | French blue, dark. |
| Windows inside | French blue, washed, | Hooker's green. No. 2, |
| Windows out- | Payne's grey, washed | dark. Hooker's green, No. 2, |
| _ side | dark | dark. |
| Rain-water pipe | Prussian blue, outline | Prussian blue, outline. |
| Soil pipe | Burnt sienna | Burnt sienna, outline. |
| Water | Prussian blue, washed | Prussian blue, lines, |
| Existing timber | Indian ink, pale | Indian ink, etched. |

Storm Overflow in Sewer.—The most satisfactory storm overflow is formed by fixing a weir at the necessary height along one side of the sewer, so that the flood water passes over the weir and escapes into the intercepting sewer. This arrangement is shown in plan and section in Figs. 1 and 2. If the overflow is required at a bend in the sewer, it may be arranged as in Fig. 3. By another method a hole is formed in the floor of the sewer; the sewage ordinarily passes down this hole, and, when there is an excess of storm water, the surplus passes over the hole and along the intercepting sewer, as shown in Fig. 4. It is impossible to calculate the size of the opening, owing to the varying velocities at which the sewage reaches it; and this method of intercepting flood water is, in general, only used when the sewage is small in quantity and the flood water is excessive. A more satisfactory arrangement is shown in Figs. 5 and 6, where an earthenware bend of the proper diameter is fixed in the bottom of the sewer, and the weir is formed on the top of it in concrete; the diameter

will dissolve. That which does not dissolve is the adulterant. (a) If white-lead is boiled in nitric acid and allowed to settle, the sediment will be the adulterant. To test the covering powers of different samples of white-lead, mix them into paint, separately weighing out the vehicles, and, having prepared two black boards, one for each sample, paint one coat of colour all over the board, paint another coat over two-thirds of its surface, and a third coat over one-third. It will then be seen which sample possesses the greatest covering power. To test the fineness of white-lead, rub both samples in a measured quantity on the same piece of glass. By holding the glass up to the light, any difference in fineness as well as of density will be seen.

Distemper for Ceilings.—Whiting should be added to the water until the former is just covered. If this is done overnight, by next morning the whiting will have absorbed as much water as it will carry, and any surplus can then be poured off; four balls of whiting will make



of the pipe may be arrived at by gauging the ordinary dry-weather flow in the sewer; or, in the case of a new sewer, by calculating what the flow should be from the number of houses discharging into it. In the figures, s is the sewer, F 1 s the flood-intercepting sewer, and w the weir.

Testing White-lead for Impurities.—White-lead contains 70 per cent. of lead carbonate and 30 per cent. of lead hydrate. The following are tests for impurities:

(a) Scoop out a hollow in a square block of charcoal, and in this hollow place the white-lead to be tested. By means of a blow-pipe direct the outer part of a flame upon the white-lead, and in a few minutes it will be converted to him lead. The residue, which will be in the form of dust, will be the adulterant.

(b) The specimens of white-lead should be rubbed up with a little sulphuric acid on a glass slab, using a bone palette knife or strip of glass. If the lead is of good quality a smooth pulpy mixture will he the result. If the lead is had, a curdy incohesive mass will be produced. (c) Mix the white-lead with turpentine, and allow to settle; pour off the liquid, and mix the residue with benzinc, and allow to settle; again pour off the liquid, and dry the residue on hlotting-paper. If this dry residue ts sbaken up with nitric acid, all of it that is pure lead

a pailful of distemper, and the balls should be broken into pieces the size of the fist. When the water has been poured off, add a little ultramarine or blue-black, in order to correct the yellowness of the whiting, and well stir and thoroughly incorporate the mass with the bare hand. Meanwhile, put 2 ib. of size—patent size is preferable—into a pot, which place over a fire, adding only sufficient water to liquely the size and prevent its being burned. When the size is dissolved, add it to the whiting, with constant stirring, then strain the distemper through a scrim or a gauze wire screen into a clean pail, and set it aside until cool, when it will have become slightly gelatinised, in which condition it is fit for application. Rather more size should be used in summer than in winter; and, if the weather is very warm, it may be necessary to stand the pail in cold water before the size will settle into jelly. The aim in distempering is to produce a solid dead coating, to ensure which it is necessary that the edge of the work should be kept "alive"; if the ceiling sucks very badly, this will be difficult, if not impossible; so in order to prevent the patchy appearance which would otherwise result, the surface is treated to a preliminary coat of size, termed clearcole, a little whiting being sometimes added. This will stop excessive suction, and give the work a chance to dry evenly.

Origin and Durability of Flagatones.—The flagstones used for footpaths are usually the so-called York
flagging, much of which comes from Lancashire. Slates
are also used to a slight extent, and so is granite. The
latter is naturally too expensive in first cost and in
manipulation to be much used, and is also too elippery
to he much in favour as a material for footpaths. Slate
is subject to the same disadvantage, and even in the
towns of North Wales, where the slate is cheap, flagstones are preferred for the best work. The flagstones
of Yorkshire and Lancashire are obtained from the Millstone Grits and Coal Measures of the Carboniferous
formations. They vary in quality according to the
quarries from which they are taken; but excellent flags
are to be had from the neighbourhood of Burnley and
Wigan, in Lancashire, and Elland, in Yorkshire. In
Scotland, good flags are obtained from Cromarty, Nairn,
and Caithness. The Caithness flagstone is vory hard,
compact, and close-grainad, occurring in beds of from
1 in, to 9 in, thick in the Old Rad Sandstones of the district. It does not scale in wear, is very durable, and is
not affected by frost. All sandstones are naturally
porous and absorb water, which they retain for a long
time. In the winter time the water so retained freezes
and splits off some of the upper laminations in the softer
stones, thus tending towards their destruction. This,
and the varying qualities of flagstones, the utmost
diversity is found in the durability of the footpaths.
In some towns, as in Leicester, their length of life is
said to be six years; in others, as Wisbech, they will
last twenty-five or thirty years. In the Strand, London,
some Yorkshire flags laid in the year 1861 were subject
to a daily average pedestrian traffic of 46,000 persons, and
were thoroughly worn out in 1884. In the choice of flags,
other things being equal, it will be found that the most
durable are those which require the least dressing on
the face to bring them to a true, flat surface (that is,
the "self-faced

Cause and unequal wear will be the result.

Cause and Cure of Dry Rot in Timber.—Dry rot in timber is brought about by the growth of a fungus (Merulius lachrymans) which spreads thesif over the surfaces in the form of a white thread-like filament, the roots entering the wood, from which they derive their neurishment, and at the same time causing decomposition of the constituents of the wood, especially in the sapwood, causing its fibres to lose their cohesion, and crumble to a brown powder. Warm, damp, and stagnant air, such as is frequently found in poorly ventilated or wholly unventilated situations, as in cellars, floors covered with impervious materials, ends of beams built in walls, and behind skirtings, window backs, etc., are favourable to the development of dry rot. The general signs of dry rot are: A musty odour, swelling and warping, and a charred appearance. The wood, on heing struck, will respond with a dull, heavy sound, and in such cases as skirtings will split and crumble at a slight blow. In the case of exposed beams, if the rot has commenced from the outer surfaces, it will be, of course, at once apparent; but if it has commenced from the interior or covered surfaces, the exposed surfaces will change to a dark colour. When dry rot is discovered, if it has not penetrated too far, the timber should be thoroughly cleansed from all traces of the fungus, and be washed with one or more coats of vitriolic acid and water. On the other hand, if it has got a fair hold, the only remedy is to cut away and remove all infected pieces and all traces of tungus, substituting non-sappy, sound, and well-seasoned timber. In ather case thorough ventilation must be provided. Cold, much moisture, or circulating air, are unfavourable to the development of dry rot.

Double-margin Door.—When an extra-wide door is required, it can be made so as closely to resemble a double door—that is, a door divided down the centre and hung on two posts. This imitation is called a "double-margin door." Fig. 1 shows the plan and elevation of such a door; it consists of two outside stiles, two centre stiles, and six rails. This door is framed in two separate pieces; each part is struck out in the same way as an ordinary frame door, except that one stile of each part is rebated and beaded (as seen in plan, Fig. 1), to form the joint of the centre stiles in the door. The two portions of the door are fastened together by three pairs of fox-wedges, one pair being inserted about 3 in. abova the bottom rail, another pair about the same distance from the top rail, and the third pair a little above the lock rail. The mortise holes for thes wedges should be at least 3 in, from the mortises for the

rails, so as to leave sufficient stuff between them to resist the pressure of the fox-wedges when they are tightened up. The wedges are made of the same thickness as the tenons, usually enc-third of the thickness of the door. The stiles and rails having been prepared, and this centre stiles mortised for the fox-wedges, gine up each part, being very careful to glue up only the centre stile of each part and the ends of the rails which go into it; then put on the cramps, and wedge on this stile. When the work is dry, remove the cramps, clean

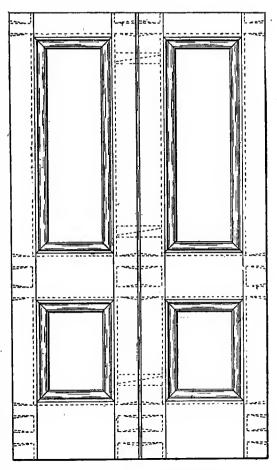
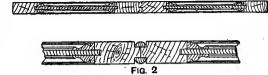


Fig. 1



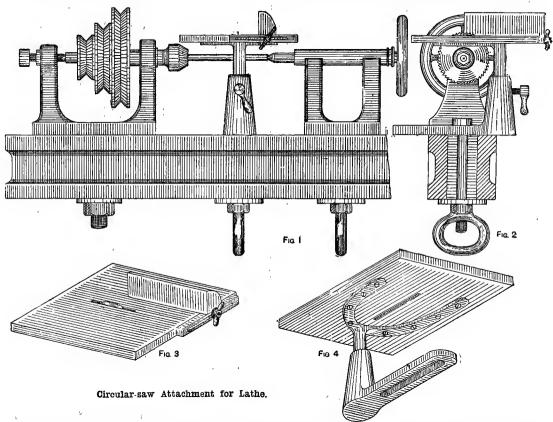
Double-margin Door.

off the ends of the tenons, and make the joint for the middle stiles; then glue the joints and the fox-wedges, bring the middle stiles of each part together, cramp the two up, and drive in the fox-wedges as tightly as necessary. When the cramps are taken off, dress off the ends of the wedges that may show in the plough groove, after which the outer stiles should be removed, the panels put in, and the outer stiles replaced and wedged on. The door is then cleaned off, the mouldings planted on the panels, and the job finished off in the usual manner. Fig. 2 shows another method of forming the joint for the centre of door.

Bleaching Superior Leather—A German process for bleaching leather used in the production of superior pale pinkish-white album covers and similar fine goods, is to immerse the leather in benzine for an honr, then to remove it, and to evaporate the benzine from the leather by heating on a water bath. The leather is then treated with liquid sulphurons acid, or eau de javelle, or hydric peroxide with ammonia. The material must be dried very carefully. The colouring properties in leather are ferric cleate and tannate, both of which are soluble in benzine.

Circular-saw Attachment for Lathe.—Figs. 1 and 2 illustrate a very handy form of circular-saw bench and spindle attachment for a lathe; it is contrived so that the table can be raised or lowered, and will be found extremely neeful for a great variety of purposes in light cabinet work, such as rebating, grooving, tongueing, etc. The spindle may be of the form adapted for lathe use. One end of the spindle is fitted into a chuck attached; to the fixed headstock, and the other end works on the centre of the loose headstock. The table (Figs. 3 and

through ft in. gauge, is mixed with the cement in the proportion of 3 or 4 parts of gravel to I part of cement, and water is added in very small quantities while the mixing is going on, until the whole is theroughly incorporated. As little water as possible should be used. The concrete is then placed in the moulds, which have been previously coated with soft soap to prevent the mixture sticking to them. To ensure sharp corners and arrises to the slabs it is well to line the moulds with sheet-iron. The concrete is rammed well into the corners, ctc., is trimmed off to a fair face level with the top of the mould, and then left undisturbed for a few days until sufficiently set to be handled. The slab is then taken off and stored away to mature in order to bring out the full strength of the cement. The setting should not be allowed to proceed too rapidly, and the slabs should not be used for paving until they are three or four months old. When pressure is used to consolidate the concrete, iron moulds, provided with iron covers, giving two fair faces to the slabs, are used, Greater strength is obtained by subjecting the material to pressure, and in some towns the municipal authori-



4) may be of hardwood, or, better, use a piece of plateiron with the top surface and the front edge at least
planed. A piece of round iron should be made to fit
in the lower part of the tee-rest, the top end being
forged to horseshoe shape, as Illustrated in Fig. 4, and
holes drilled in it to attach it to the under side of the
iron or wooden table by screws or bolts. It will he
noticed that a piece of metal is slotted so as to elide
over a screw which is attached to the front edge of the
table, the fence proper heing attached to this. This
allows of the fence being moved to varying distances
from the saw, and it can be held in any position by the
fly nut shown.

Manufacture of Concrete Flags or Paving Slabs.—
These are made by moulding concrete in iron or wooden
moulds, with or without pressure. The Portland cement
should be of specially good character, and in order that
it may be well matured it is usual to specify that it shall
be delivered at the manufactory at least a fortnight
before it is required for use. Granite, broken to the
size of pea gravel—that is to say, such as will pass

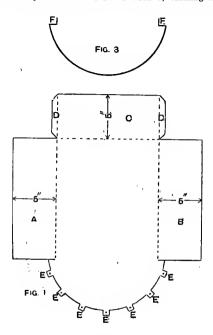
ties find it possible to utilise in this way the clinker from destructor furnaces, the clinker taking the place of broken granite. These slabs, when laid on a bedding of sand or ashes, on which has been spread a layer of lime mortar, make an excellent footpath. The joints, which should be grouted with lime mortar, can be made very fine, and as the slabs are uniform in size, all the joints are disposed in straight lines, and present a pleasing appearance.

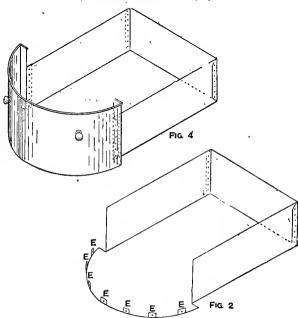
Torching Slates or Tiles.—Torching is the pointing of the joints of slates or tiles on the under side when laid on battens, to prevent cold winds and dust from blowing through. The material used is coarse stuff—that is, lime and hair mortar—with which the whole of the under side is sometimes rendered to keep cool the space between roof and ceiling. When laid on close boarding, the slates or tiles are sometimes bedded in mortar as an equivalent for the torching, which cannot then be done. Tarred or so-called asphalted roofing felt is employed for similar purposes on either battens or boarding.

Electrification of Glass by Friction.—This method does not always give certain results, opposite kinds—positive and negative—being produced in circumstances practically identical. Thus, a strong positive charge may be given to a smooth rod of soda glass by rubbing it gently with a certain piece of fur, whereas vigorous rubbing produces an equally good negative charge. The two sorts may be produced at one stroke by making the friction small at first and finishing with a vigorous pull; and the half-way region of zero electrification may be displaced at will. The same plece of fur always positively electrifies a piece of lead glass.

Ash pan for Fire-grate,—Of the several methods of making ashpans for fire-grates, the following is as good as any: Having taken the size of the space under the fire-grate that is to be fitted, cut a piece of sheet-iron (not too thick) to the shape shown in Fig. 1. It is advisable, when the opening beneath the tray is sufficiently large, to have the sides of the tray (marked A, n, c in Fig. 1) 4 in. or 6 in. deep, so as to prevent the ashes from falling out when the tray is moved. The sides A and B should be turned up first at the dotted lines; then do the same with c, turning at the same

length in feet on B, and against quarter girt on D find the cubic feet contents on C, but when D scale commences at 4, divide the gauge-point 144 by 16. making 9 on A. Example: Quarter girt, 18 in.; length, 16 ff. Set 144 on A to 16 on B, and against 18 on D we have 36 on C. Or, when D commences with 4, set 9 on A to 16 on B, and against 18 on B we have 36 on C. For measuring squared timber, scantling, or boards, by means of a slide rule, to obtain true contents set 12 on B to width in inches on A, and against the length in feet on B will be the area in square feet on A. Then set 12 on B to the area on A, and against the thickness in inches on B will be the contents in cubic feet on A. Example: 22 it. of 9 by 3. Set 12 on B to 9 on A, and at 22 on B will be 16½ on A, equal 16½ ft. super. Then set 12 on B to 16½ on A, and at 3 on B will be 41 on A, equal 4½ cub. ft. The slide rule is a logarithmic scale. The lines A, B, and c are known as "double lines," being all divided identically; and line n, having divisions twice the size, is known as the girt line. It requires some little practice to be sure of the results, but by making a selection of examples and working them out arithmetically, a check can be had upon the work of the slide rule. Lines A, B, and C are marked





Ash-pan.

time the two laps marked D, on each side of C, round to A and B so as to be able to rivet them well together. Next turn up the pieces marked E on Fig. 1. Upon these the front is to be fastened (see Fig. 2). Take a strip of brass or copper and mark off § in. at the top edge, and turn it over a piece of § in. wire so as to give a neat finish. Next bend brass, as shown in Fig. 3, to suit front of Fig. 2, then mark off holes to correspond with those marked E in Fig. 2, and bolt the brass to the iron bottom with small brass-headed bolts and nuts; then rivet the brass to the iron sides where marked F on Fig. 3, so as to make it perfectly firm. The handles can be bought, with nuts and threads ready for fastening. The knobs should be fastened on with nuts in preference to being soldered, so that they can be taken off when the pan is being cleaned. Fig. 4 shows the finished ash-pan.

Measuring Timber with Slide Rule.—For measuring growing timber, a leather strap is used, marked on one side in inches and quarter inches magnified four times, and on the other side into the same measurements plus an allowance for bark. The strap is thrown round a tree at a height of 6 ft., and the magnification of the measurements is for the purpose of giving the quarter girt without calculation. Then quarter girt squared, multiplied by the length in feet, and divided by 144, gives the assumed contents in cubic feet. The quarter girt is supposed to be equivalent to the side of a square log of equal bulk, but the result is merely the customary sale contents, and not the true contents. To get the sale contents of a tree by slide rule, set 144 on a to

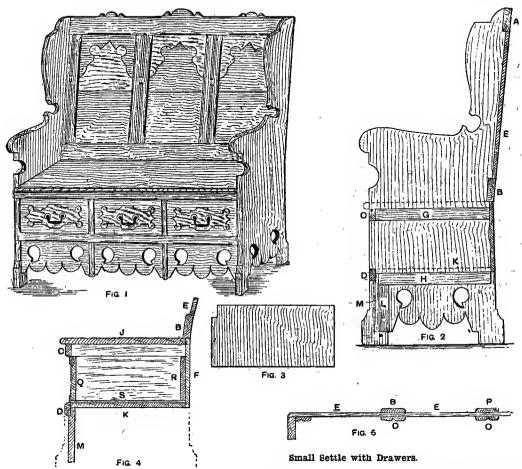
from 1 to 10 twice over. The first point may be taken as 1, 10, or 100. the second 1 will then be 10, 100, or 1,000, and the intermediate divisions will vary accordingly.

Gutta-percha Moulds for Architectural Ornaments.—Gutta-percha is used by plasterers for forming moulds for enrichments, and probably the same material would answer for copying architectural details. It is brought to a plastic state throughout the whole of its mass by heating in hot water; it is then pressed firmly over the part to be copied, and fixed there until the loss of heat brings it again to a somewhat rigid condition. Care must be taken, with any underent portions, not to damage the mould or the stone, but the gutta-percha will permit of a little undercutting if not left until too cold. A model in plaster-of-Paris or a besswax composition could then be obtained from the mould.

Bending Lead Pipes. By winching lead pipe bends is understood that a bobbin with a rope through it is dragged through the pipe and bends by means of a winch fixed on the end of a bench. This is sometimes practised instead of using followers and driving-rods to force the bobbin through. The practice of winching is not good unless carried out by a very skilful workman, as the heel or outside of the bend is made very thin during the process unless very great care is taken. There is no better process for bending large pipes than the ordinary one of slightly bending the pipe, then dummying out the buckle throat, and repeating the process until the pipe is bent sufficiently.

Small Settle with Drawers.—The length of the settle illustrated by Fig. 1 is 3 ft. 3 in., and its seat is 1ft. 6 in. high, whilst the back rises some 2 ft. 2 in. higher. The ends should be strong, I-in. board being suitable. Fig. 2 shows the inner side of one end, those parts which come in contact with it being also indicated. The settle is put together quite simply, so that it may be well within the power of the amateur workman. For each end the boards, when joined together, are 1 ft. 6½ in. wide; two widths will doubtless be used, and these should be united with dowels, in addition to the ledgers G and H (Fig. 2). The widths for the back are 3 ft. 7 in. long, and those for the front 2 ft. 6 in.

at each end to pass through a mortise in each end piece and be pegged outside. But usually this will not be necessary, the settle being strongly bound together by its rails, back boards, etc. The seat is screwed down on the ledgers, to the rail c, and to the upright partitions (Fig. 3) between the drawers. Screws will also be driven into it from the back board. Two rartitions for dividing the drawer nocks stand between the floor and the seat, their front edges showing in Fig. 1. They are of 3 in. board, 7½ in. high and 1 ft. 5½ in. from front to back. A notch, 1½ in. by ¾ in., is cut in the top front corner of each for the rail c. These partitions are also fixed by screws driven upwards through the floor,

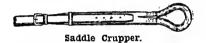


In the hinder edges are two cuts, A and B, ½ in. deep by 3 in. long, for the two back rails. In the front edge also are two cuts, c and D, ¾ in. deep and 1½ in. long, for the rails of the front. The back rails, projecting ½ in., form between them a space for the back boards E (Figs. 2 and 5), while below the rail B another space is formed for the back board F (Fig. 4) of the drawer nooks. On c (Fig. 2) rests the end of the seat J (Fig. 4), and on H (Fig. 2) the end of the floor K (Figs. 2 and 4) on which the drawers slide. These ledgers are of 1-in. board, 1½ in. wide; G is 1 ft. 2¾ in. long, and its top is 1ft. 5¾ in above the ground line. 4at L (Fig. 2) an upright strip is also screwed to the end; this and its fellow are for the support of the ornamental skirting-board M (Figs. 2 and 4). The floor K is of ½-in. board, 5ft. 1 in. long by 1 ft. 2¾ in. wide; it is screwed down to the ledgers, screws also passing into it through the lower front rail and through the back board. The seat, which is of ½-in. stuff, 1 ft. 4 in. wide, is also drawn as 5 ft. 1 in. long, but should extra length be desired, it may be cut 6 in. longer, so as to allow of a 3-in. tenon

whilst others pass into them through the back toard and top rail. The two front rails are of \$\frac{1}{2}\$-in. board, \$1\frac{1}{2}\$ in. long. They are screwed to the end pieces, through which they pass, whilst screws also pass into c through the seat. Their edges, like those of the partitions, are stop-chamfered round the openings for the drawers. The \$\frac{1}{2}\$-in. back board, which completes the frawer nooks, is \$\frac{1}{2}\$-in. back board, which completes the screwed to the end pieces, to the seat, and to the floor. The ornamental skirting board \$m\$, of the pattern shown in Fig. 1, is \$\frac{1}{2}\$-in. thick, its width being 7 :n., and its length 3 ft. 1 in. It has a shallow 1-in. rebate along its top front edge to enable it to fit behind the rail \$n\$. It is screwed to that rail and to the strips \$L\$. It will be observed that it lies back from the level of the ends, rails, etc., by \$\frac{1}{2}\$ in.; also that two strips of \$\frac{1}{2}\$-in. hoard, \$\frac{1}{2}\$ in. wide, are screwed on its face in continuation of the lines of the partitions, with which, as well as with the rails and ends, they come flush. The construction of the lower part of the settle is shown in Fig. 4, which is a central vertical cross section. The lower rail \$\frac{1}{2}\$ to the back is of 1-in. boand, \$\frac{3}{2}\$ in. wide and \$\frac{3}{2}\$ if. which is a central vertical cross section. The lower rail \$\frac{1}{2}\$ to the back is of 1-in. boand, \$\frac{3}{2}\$ in. wide and \$\frac{3}{2}\$ if. not the long, and its lower edge must be planed to an angle to fit the seat. The cuts made for it in the end pieces being only \$\frac{1}{2}\$ in. deep, it projects when in place \$\frac{1}{2}\$ in.

beyond those pieces. This applies also to the top rail A, except that it is 5 in. wide, to permit of the ornamental shaping of its upper edge. Both these rails are strongly screwed to the end pieces, and when fixed are 1 ft. 6 in. apart, leaving a space between them to be filled by the back boards E, which are \(\frac{1}{2}\) in thick, each being 9 in. by 3 ft. 3 in. They also are screwed to the end pieces. Fig. 5 is a cross section through the centre of the back. The boards just mentioned serve as its panels; and as eitles to frame them in, in conjunction with the rails, four upright strips of \(\frac{1}{2}\) in. board, 1 ft. 6 in. long, are used; of these, two which fit close against the end are 2 in. wide, whilst the others o are 3 in. wide. For decorative reasons a broad groove is run up the face of each, as shown in Fig. 1, and the edges, as well as those of the rails adjoining the panels, are stop-chamfered. To bind the whole back together are two other upright strips r, also of \(\frac{1}{2}\)-in. wood, 3 in. wide and 2 ft. long; they are strongly screwed to the two rails and also through the back boards, and they render the whole back strong and rigid. The ornamental spandrels of the panels are sawn from \(\frac{1}{2}\)-in. board and fixed by small screws. The front Q, the back R, and bottom s of one of the three drawers are shown in section in Fig. 4. These drawers, before the ornamental spandrels are fixed to their fronts, are 6 in. deep, 11\(\frac{1}{2}\) in. wide, and 1 ft. 2\(\frac{3}{2}\) in. from front to back outside. The fret-cut spandrels, which are in \(\frac{1}{2}\)-in. wood, bring their fronts to the same level as the board M. The drawers may be put together as shown, the sides and bottoms being merely bradded to the front and back, as the spandrels will hide unsightly edges.

Saddle Cruppers.—Full-sized saddle cruppers (see the illustration below) are made about 1 in. wide, and sometimes a little more, the body being about 1 ft. 6 in. long, with a slit of about 5 in. in one end, the other being turned in for a 1-in. buckle; shave the points of the slits and the end of the chape. Having cut a billet of the same width as the buckle, and

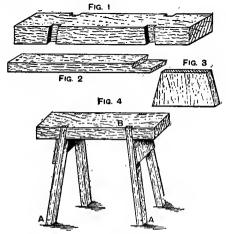


2 ft. 4 in. long, trim one end for the buckle and shave the other. Edge them and polish the edges, creasing them with a hot checker. Adjust the buckle and stitch the billet, making the first stitch by the buckle over the edge and the chape and billet together, and the next stitch through the loop. Now run four or five stitches towards the point on each side, and return to the buckle on the other side, making the last stitch over the side the same as the opposite side. Put a loop on the flat lower down the body of the crupper, say about 6 in. from the buckle, stitching it across in each end, and then make a dock much smaller in circumference than the gig crupper dock, the leather being cut about 1 ft. 1 in. long. Next take a piece of string about 1 ft. long, and roll wet brown paper round it until it is of the requisite thickness in the middle; thin the ends by cutting the paper before damping it. Stitch the leather over it as it is, without cutting a groove, drawing it very tightly over the paper. See that the leather is soft and pliable, and damp it before stitching. Having dried the dock, finish it in shape, and then stitch the dock to the slits, giving it about a l½-in. splice. Put about a dozen holes in the billets and vary their length according to the size of horse for which they are intended.

Testing Disinfecting Powders and Liquids.—The amount of carbolic acid in a liquid is determined by pouring into a burette a measured amount of the liquid, adding a large quantity of caustic soda solution (10 per cent. strength), and measuring the residue of tar olls left after shaking. Supposing 10 c.c. of liquid were taken, and after shaking 2 c.c. of other liquid contains 80 per cent. of carbolic acid by measure. The powders containing carbolic acid are of two kinds—those in which the base is a silticious material and those having lime for a base. In order to determine what is the base, place a little upon litmus paper and moisten it with water; the silica powders are acid and the lime powders are alkaline. In the case of a silica powder, weigh out a portion and introduce it into a stoppered retort, add a little water, and distil on a sand bath to dryness; again add water, and repeat until no oily drops appear in the neck of the retort. The receiver will contain a solution of carbolic acid in water, and also a layer of acid at the bottom. Pour off as much of the water as possible, and measure it. Pour the remaining water and the carbolic acid into the burette. Add common salt to the water in the burette

until the acid rises to the surface, then read off its volume. Add caustic soda as above, shake, and again measure the oily layer. The difference between the two is the amount of carbolic acid contained in the powder. For a lime powder, weigh out a portion, mix in a mortar with a little water, then add gradually sulphuric acid (previously diluted with three times its volume of water and cooled) until on testing the paste is found to be acid. Then wash into retort and proceed exactly as above. As carbolic acid is soluble in water, a correction will have to be applied. The solubility is 1 pt. by measure in 11'1 pt. by measure of water, therefore, for each 11'1 c.c. of water distilled over with the acid add 1 c.c. to the measure of carbolic acid found. The determinations of carbolic acid given above are all by volume; to convert them into percentages by weight, add one-twentieth—thus, in the instance mentioned, 80 per cent. by volume is 84 per cent. by weight.

Carpenter's Sawing Stool.—Take a piece of board 53 in. by 1 in., and cut end 13 in. out of square (as Fig. 3). Set bevel to this, then take lengths of 43 in. by 3 in., 2 ft. 6 in. long (as Fig. 1), which is to form the top, then apply bevel 6 in. Irom end and gauge 3 in. deep and house out the 3 in. parallel through to take the four legs. This same bevel will give the two cuts that form the under sud side cuts for shoulders on legs,



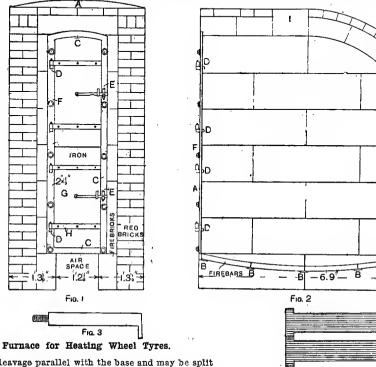
Sawing Stool.

as shown in Fig. 2. To get down-cut on legs, take a piece of 3 in. by 3 in. and on the top from outside mark 1½ in., from inside at ehoulder mark ½ in., which will give, down-cut. Be careful that the housing out is not too wide, as the legs should be driven in quite firm; then nail. Now take the piece shown in Fig. 3, and with the plane take off the outside edge so that it will take a solid bearing under the top. Then take a 2-ft. rule and place it up each leg, from A to B; this gives a good height for a stool. Mark off this height, then, with straightedge, mark from A to A (as Fig. 4). First mark sides, then ends. Cut off each leg as marked with etraightedge; you will then have a stool that will stand solid. Be careful that the detail shown by Fig. 3 is 5¾ in. deep, as on that will depend the three main cuts.

Re-tinning Copper-bit.—To re-tin a copper-bit, heat the copper as though for soldering, file the parts to be tinned, put some resin on a soft brick, and rub the filed parts on the brick and in the resin, which the heat of the copper will melt. While rubbing the copper on the bit, press a piece of "fine" or "half-and-half" solder on the part to be tinned, and a film of solder will adhere to the copper. The surplus resin will adhere to the brick, and the surplus solder will remain on the resin. To re-tin the bit when necessary, again file the copper and rub it on the brick. The resin and solder already there will suffice for several operations, and more resin and solder can be added as required. Tinning the copper in this way is best effected when it is barely hot enough to melt the solder. If it is too hot, the filed parts tarnish or oxidise before the resin and solder can be applied. Or the filed copper can be rubbed on a block of sal-ammoniac and the solder applied, or it can be dipped in "killed" spirits of salts and applied to the solder. In these two ways the copper is eaten away very quickly by the sal-ammoniac or the apirits. Resin is the best flux to use.

Occurrence of Mica.—Mica is one of the commonest of the minerals that make up the earth's crust, its glassy lustre proclaiming its presence in granite, gnelss, schists, and the like; in some places the ground is covered with it. It combines with quartz and felspar to make granite, and all three are products of ierrestrial heat, and are invariably formed when cooling is sufficiently slow. In only a few regions of the earth occur dikes containing mica in paying quantities, and there are never any certain indications of its presence. When it is present, the mica hocks often follow a distinct lead, but this often is discontinuous. Nor are leads always present, for the mica often occurs bunched together in pockets, in great agglomerations of crystals, or even in single large crystals. The mica as it comes from the mines is in rough and uneven blocks, which have a very

the plate, and fixed by nuts on the inside; they carry the hinges of the doors. Two catches E (Fig. 1), to take the latch of the doors, should also be riveted in. Holes being drilled through the plates, the strap bolts are fixed on the front by flanged nuts F (Figs. 1 and 2). The doors G (Fig. 1) are made of 4-in. sheet-iron, and should be a good fit, the hinges H being secured by three rivets in each hinge. The cast fire-bars (Fig. 4) are full 3½ in. wide at each end, a space of 1 in. being left between each pair of hars. They are 1 ft. 6 in. long by 2 in. full deep, and are beveiled at the ends so as to fit close together in the drop of the grating. The air space for draught should be left the whole length of the furnace. The space I (Fig. 2) is left for the chimney, which should be of a good height to increase the draught. When the furnace is loaded with four or five



perfect cleavage parallel with the base and may be split up into laminæ thinner than the thinnest tissue paper; the exterior portions of the blocks are opaque, brittle, and worthless, presumably from the penetration of water, as mica soon decomposes when exposed to weather

Waterproofing Soft Felt Hat.—For waterproofing a soft hat, sponge the inside of the hat with a warm solution of soap, 20z. to the pint, then apply a solution of alum, 20z. to the pint, and dry. If the hat is a light-coloured one, it could be dipped first in the soap, and then in the alum; this will more effectually waterproof the hat.

Furnace for Heating Wheel Tyres.—A furnace for heating wheel tyres is shown in Figs. 1 and 2. Firebricks, 3 ft. long, 1 ft. wide, and 6 in. deep, are used for liming the whole of the inside, and these bricks may be obtained of Harriss and Peacock, Stourbridge, Gloucestershire. The outer casing is a 3-in. solid brick wall at each side, and on the top is laid a 2½-in. course, which is usually covered with concrete, as shown at A (Fig. 1). This is continued down to the bottom of the back part. Before fixing the fire-bricks, make recesses for the iron bars B (Fig. 2) that carry the fire-bars, the drop in the centre being 4 in. Places should be cut out to fix the iron strap bolts (Fig. 3) which go through the iron frame (Fig. 1) of the doors. This frame is welded at each corner, and is made of 2-in. by ½-in. iron. On the inner face a frame of stock hooping, 2½ in. wide, is riveted, and projects over the inner edge of the frame ½ in. all round. The frame is then large enough to take a 5-ft. 10-in. tyre, which is rarely used. With the height suggested, it is possible to feed the fire from the top door. Gudgeons D (Figs. 1 and 2) should be let through

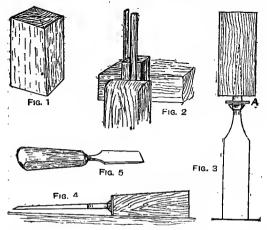
tyres, and nearly filled with shavings and wood from the waste heap, the tyres should be not enough to shrink on about twenty minutes after the fire is lit. Fit the lightest tyres first, and as each tyre is taken out put in another, replenishing the fire as required; the fresh tyres will be ready after the first four are in place.

Fig. 4

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Repairing Backbands and Traces.—If backbands and traces are thick, splicing should if possible be avoided. Shave both ends of the break, and just tack the ends together, then put pieces of leather at beth sides until the required thickness is obtained, the pieces being shorter and thinner-shaved at the ends nearer the centre. As a rule, stitch four rows along the patch, and one or two stitches in the centre of the points. If the entire part, such as the holed part in a trace, is not worth patching, put in a new piece, keeping the old one to mark the new; the joint at the splice must be very neat, not thick and clumsy. Likewise, if the other end is gone, add a new piece, making it thicker than at the other parts. When the centre of the backhand is not worth patching, make a new centre, but generally the strap end and beliyband part can be used, Having measured the part, cut off and allow enough extra to make a splice in each end; put the strap in one end and the bellyband in the other.

Fitting Handle to Chisel.—Some woodworkers like to make their own chisel and gouge handles. The turned handles may be bought cheap, and only require boring and driving on; but the old octagonal handle still holds its own where hard and rough work is required. Boxwood is the best for the purpose, but must be carefully handled, as it is liable to split in driving on. A hard, tough piece of brown ash makes a very good handle, that should last as long as the chisel. Beech is often used for the purpose, but will not stand much rough work. Yew is sometimes used, but it is rather liable to split. Apple-wood makes a nice-looking handle, but it is too soit to stand much knocking about. Hornbeam, laburnum, rosewood, and other woods that might be mentioned, are sometimes used for tool handles. Having selected the piece of wood, the first job is to square it up roughly, then find the centre at one end by drawing the diagonals as shown at Fig. 1. Next fasten two strips of wood to one of the sides as abown in Fig. 2, and screw the block, together with the strips, in the vice. Then take the smallest pin-bit from the set, and bore a hole the full depth of the tang off the chisel to be handled. The two upright strips of wood will serve as a guide to keep the bit true with the block in boring. Now, with a hollow taper-bit—or wood-rimer, as it is sometimes



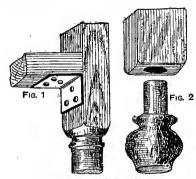
Fitting Handle to Chisel,

called—taper the hole to roughly fit the tang of the chisel, until the shoulder is about \(\frac{1}{3} \) in. from the handle, then with a narrow chisel square the hole and fit the tang in to within \(\frac{1}{3} \) in. for an ash handle, or a little less for boxwood. A leather washer, shown at A (Fig. 3), may be put on the tang to serve as a cushion between handle and shoulder, and this will add considerably to the lasting properties of the handle. Next, put the cutting edge of the chisel on a cross-grained pleee of wood, as at Fig. 3, and with a few smart taps with a mallet drive the bandle home. The next process will be to clean the handle up to shape. First taper it roughly with the axe or mallet and chisel, frequently trying it on the edge of the bench or with a straightedge, as shown at Fig. 4, to prove that the centre-line of the chisel lines with the centre of the handle. Having roughed out the shape, plane it to the finished size, still trying occasionally, to ensure it lining correctly; then plane off the corners and round the top. A few strokes with the wood file, and a final rub with sandpaper, will complete the job. The handle shown at Fig. 5 is an improvement on the old octagonal shape, especially for paring-chisels and gouges. The oval form fits the hand better, giving more command over the tool; and it is not much extra trouble to clean up the handle to this shape. Some workers finish the handle with a rubber of French polish. This gives it a nice appearance for a time, but it soon wears off. A better plan is to give an occasional rub with linseed oil. This, with the friction of handling, gives a lasting polish that improves with time.

Principles of Internal House Painting.—As the colouring to be applied to a room will often depend to a large extent on the colour of the curtains and of the carpet, not much latitude is given to the painter. The ceiling should contrast with the carpet; the curtains and chair coverings should be met with a contrast on the walls and woodwork. The aim should be to get colour, not colours, so the contrasts should be in harmony. Rooms with a cold aspect should be warm; in a warm aspect should be cool. Bedrooms should be light,

quiet, and cool; dining-rooms rich; drawing-room in colours which are cheerful in character and which light up well at night. The staircase will present a comfortable and inviting appearance. If a room is well lighted, the colours must be kept subdued, but when the room is sombre the colours may be brighter and less neutral. Neutralisation of colour is the great law of colouring. The principle of neutralisation, by which each colour is toned down by admixture with its complementary, not only subdues a colour without destroying its beauty, but reconciles it with the other colours that are in proximity to it. It produces a relationship between all colours, and keeps each in place, which is a fundamental principle in decoration. As the wall surface is a background to everything in the room, it should harmonise with everything, and a sympathetic tone should run through all the colours used. If the colour of the furniture is warm, a warm tone should appear in the paper; if cool, a cool tone. If a wall is red, the red should be reproduced in the woodwork, and so on. Contrasts should be harmonious, and this may be obtained by neutralisation and use of complementary colours.

Repairing Old Furniture.—Chests will generally be fairly sound, but it is not so with such things as chairs and tables. Up to somewhat later than the middle of the seventeenth century it was the rule that these latter articles should be tied by cross-bars mortised into the legs near the ground; and rough usage



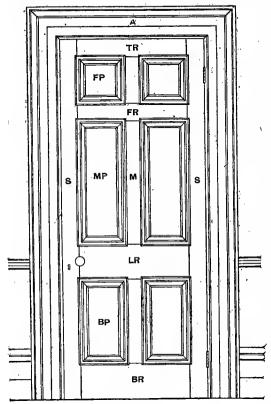
Repairing Old Furniture.

and exposure will often cause these mortises to work loose. Provided the wood is sound, the joint may again be made firm by driving in one or more thin glued wedges. It moisture has lodged in the joint, and tenon and mortise are alike tender, still drive in wedges to tighten the joint, but in addition screw an angle-fron (Fig. 1) beneath the cross-bar; this, if let into the wood, will scarcely be seen, especially as it must be painted to match. Such irons may he used with advantage for strengthening purposes in other places, as in the upper frames of tables, etc. The smaller tables, as well as chairs, joint-stools, etc., commonly stand on ball feet, and these are usually defective. To substitute new feet is, however, a simple matter. The original limbs are sawn off, as in Fig. 2, and holes are bored as shown, and in them the shanks of new ball feet, turned to match the old, are glued. Nails are sometimes thoroughly rusted into the wood. Should the nail come out leaving a clean hole, a mere stopping of coloured putty—putty kneaded with vandyke brown or burnt umber—may suffice. If it is difficult to get a good grip on these old nails without bruising and disfiguring the surface, it is better to sink a hole round the head with the gouge till a firm hold can be obtained. The hole so made can be readily trimmed to shape, and a fresh piece of wood let in and glued, due care being given the front seems desirable to strengthen any crazy plece of old work, it will be found that to countersink deeply, and to hide the head in this manner, is the best thing.

Chain to Lift Three Tons.—To lift three tons with safety on a single chain, an \{\frac{1}{6}\cdot \text{in.}\ \text{ chain is required, that is, one in which the iron used for the links measures \frac{1}{16}\cdot \text{ in.}\ \text{ diameter. Such a chain requires pulleys 2\frac{1}{2}\cdot \text{ iu.}\ \text{wide between the fianges.}

Preserving Cut Flowers. — The flowers may be sprinkled constantly with water and their stems placed in a mixture of 30 parts by weight of water, 30 parts of white soap, and 3 parts of salt. When the soap has dissolved entirely, a small quantity of borax is added. The process is particularly useful to those who make a speciality of photographing cut flowers.

Painting Front Door.—The illustration below shows the inside of a six-panelled door. In painting a new front door, the knots should be cut out, and new wood inserted. All resin should be burnt out as far as possible by flame, and sealed down with patent knotting or metal-leaf. The door should then have a coat of priming (cily); an old door should be well rubbed down, faced up with putty, and old knots showing through the paint should be gouged out, and filled up with hard putty. Then the whole work may be brought forward. The second colour may be one-third turpentine to two-thirds oil. The second colour is to level up both the surface and the colour, and to stop unequal suction. For a front door the coats should be made up with japanner's gold-size as a binder instead of raw linseed oil. The third and fourth coats may be rounder. For an inside door the coats should be alternately oil and flat, finishing in every case with a flat coat for varnish.



Parts of a Door.

Each coat of colour should be well rubbed out till the face of the work is solid, level, and even. The object aimed at in every coat should be to bring the work up to the finishing colour. The ground for the flat finish should be darker and more neutral than the finishing flat. In painting a door, the left hand top panel, with the moulding, may be done first, the other panels next, at the same time wiping off colour on the stile; a flat fitch will take the colour into the quirks and clear it from the mitres. The muntins are the next to receive the colour, then the cross stiles, and the outer stiles last. Care must be taken to avoid gatherings and fat edges, and the colour should be laid evenly and well crossed. In the above illustration, A signifies architrave, B P bottom panel, B R bottom rail, F P frieze pauel, F R frieze rall, L R look rail, M muntin, M P middle panel, S stile, and T R top rail.

Choice and Care of Circular Saws.—Thick saws are wasteful both of power and of material. A saw of 2-ft. diameter and No. 30 gauge, with about fifty teeth, will be suitable for the general work of a small shop; indeed, this size of machine will not generally hold a larger saw than 2 ft. A saw of this diameter should not have much set; about $\frac{1}{10}$ in is quite sufficient for ordinary work. For cutting rebates, tenons, etc., a 16-in,

saw, No. 16 gauge, is found very suitable for this class of machine; saws smaller than this are not of much use, as they run so slowly at the cutting edge that they get through very little work. A large saw requires slightly more set than a small one, as there is more surface of plate to clear. For setting saws, nothing is better than a small set-gauge with a plece taken out at the slde equal to the required set; and all setting should be as near the point of the teeth as possible, and be done with an ordinary saw-set. To do good work, the saw should be thoroughly true around the outside, the gullets should be all of the same length, and each individual tooth should do its own share of the work. When the saw is trued up, the cutting edge should be exactly square, che saw will lead to the high side, and waste a lot of wood. The saw should be tested by making a cut in a plece of wood. A plece of hard freestone should be used for truing up the cutting points of the saw if is soft stone is used, the saw is very apt to cut a groove in the stone, which will grind the side of the tooth that has to form the cutting point. The gullet of the saw should be filed almost square across, and the top should have a slight bevel. A 7-in. mill saw file is the best tool for this purpose, as it deepens the gullet at the same time. Gulleting the saw with an emery wheel, if done periodically, is not objectionable; but if the plan is adopted when the teeth are very short, they are liable to become ease-hardened, the tension of the blade becoming altered, so that the saw must be sent to the maker to be put right. The better way is to have the saw punched, which can be done very cheaply by any saw maker, who should also be informed what kind of wood the saw will he used for, and he will then give, it the required lead and bevel on the top. The packing of a saw is another very lmportant matter. The packing of a saw is another very lmportant matter. The packing of a saw is another very lmportant matter. The packing of a saw is another ver

mended, as it can be done more quickly and with less setting by the vertical spindle moulder.

Tar Paving for Footpaths.—Tar paving, while less durable than natural asphalt, forms a very useful and economical covering for footpaths. The mode of preparation is briefly as follows: Small stones are thoroughly dried and heated and mixed with gas tar, which is allowed to soak into the substance of the stone; this composition is then laid on the foundation and well rolled. The details of the process vary slightly in different districts. One of the earliest mixtures, known as Lord Stanhope's composition, consisting of 30 gal. of Stockholm tar mixed with 20 bushels of ohalk and 10 bushels of clean sharp sand; these were all boiled together in caldrons, and laid while hot to form the surface of the footpath. Good foundations are essential in this as in any other kind of paving. Hard ballast, cinders, or broken stone, 3 in. or 4 in. thick, should be laid and well consolidated by rolling. To economise material, the surface of the foundations should be brought to the exact level required, and to the slope required on the finished surface of the path. This alope may be \(\frac{1}{2} \) in. or 4 in. thick, according to local requirements. In one of the simpler methods of preparing this bottom coating, the gravel or chippings of the required size, usually not larger than 2 in. gauge, and sometimes as small as 14-in. gauge, are laid in a heap of about 1 ft. thick, Several firee are made on the top of the heap, and are covered down with refuse cinders to cause the heat to strike downwards and completely evaporate all moisture from the stone. When the heap is covered with cinders and is one mass of fire, it is then turned over with a shovel and sprinkled with gas tar, the process being repeated until the whole of the stone has received a sufficient coating of tar. It is allowed to lie for some weeks, so that the tar may thoroughly soak into the stone, when it is laid on the foundations to the required thickness, which may be an

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Sometimes the remainder of the material is added in two costs, but usually one is sufficient. This, known as the topping, is, in some cases, a mixture of fine ashes and gravel or chippings, the whole being passed through a \$\frac{3}{2}\$-in. wire riddle. The ashes are laid on the ground to a thickness of 6 in., with 6 in. of gravel or chippings on the top, and heated by fires in the same way as in preparing the bottom coat. The tar is then added as before described, and the material, after storing, is ready for use. It is usually laid in a thin coat, say from \$\frac{1}{3}\$ in. to 1 in. in thickness, and must be well rolled. When the surface is finished, a sprinkling of very fine limestone chippings is spread over it and rolled in.

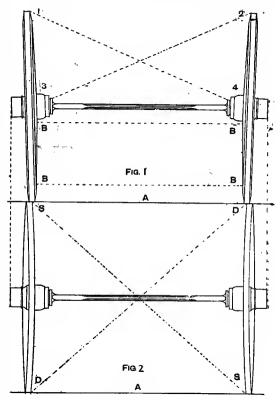
Applications of Thermite.—Thermite is the aluminium alloy whose combustion generates so much heat that the material can be used for bonding steel rails by welding. Prominent among its applications is the reduction of such metals as chromium and manganese without the presence of carbon; the operation is rapid, requiring scarcely more than thirty minutes for a charge, and the resultant chromium, being quite free from carbon, is especially valuable in the manufacture of chrome steel, whilst the manganese produced in a similar manner is used for making manganese bronze. Chromium prepared in the ordinary way contains from 10 to 12 per cent. of carbon, and its addition to steel materially modifies the carbon contents. The pure chrome is useful in preparing other alloys also, whilst pure titanium may be made and used in the same manner. Various useful alloys may be made with pure manganese, the absence of iron and carbon being especially important. Both nickel and cobalt may be reduced by combustion of aluminium, and while the cost of cobalt renders it unavallable, the production of pure nickel is most desirable. In like manner boron, vanadium, etc., may be reduced. With thermite as a means of melting and welding, and with the use of special clamps and devices, a number of operations, otherwise difficult, can be performed, and thermite bids fair to come into general use for repairing broken or defective parts. By the use of a portable jacket and clamp, the joints of gas, water, and steam pipes may be welded with the pipes in position; and the advantages of such a material to an engineer far removed from supplies and repair shop, as at sea, can hardly be enumerated. New journals have been yelded to heavy rolls, broken pump-rods have been joined, and a number of structural parts successfully united by its aid.

Magnalium.—Magnalium is an aluminium-magnesium alloy with a specific gravity between 2 and 3, and its melting point is between 600° C. and 700° C. (1,112° F. and 1.23° F.). Aluminium is comparatively soft and unworkable, but when magnesium is added it gets harder; quantities of magnesium between 5 and 50 per cent. give an alloy similar in its properties to brass and bronze. When 50 per cent. of magnesium is present the alloy is useless for mechanical purposes, but then takes a high polish, and is eminently suitable for optical use. When there is more than 50 per cent. the alloy approaches in properties to magnesium and loses its hardness. As regards durability, an alloy containing from 25 to 30 per cent. of magnesium is rather superior to aluminium, and retains its polish for a long time. Magnalium may be coined easily, being better than aluminium in this respect and almost approaching nickel. Screws and nuts can be made from it, which is not the case with aluminium. The tensile strength of magnalium plates containing 5 per cent. of magnesium is about 15 tons per 50.

Manufacturing Cycle Tubing.—First, the ingots, weighing from 1 cwt. to 1½ cwt. each, are bored with a drill from 1 in. to 1½ in. in diameter, and they are then heated in a furnace and rolled, frequent re-heating and re-rolling being necessary until they have an external diameter of about 2 in. the metal then being about 3 in. thick. When cold, the rolled tubes are "tagged" at a Ryder hammer, and then sent to the draw benches, where they are coated with heavy oil and drawn through dies whilst mandrels are inside them, and then annealed. They are pickled to remove scale, dried, oiled, and again drawn, the series of operations being repeated until the right size and gauge is reached, when the tubes are again annealed, pickled, and dried. Having been examined, they are straightened, passed through the blueing stove, and then oiled. Of course, different factories vary the method of working, but roughly the above process is the one used in making weldless steel tubes. The sizes vary from ½ in. to ½ in., and the gauges from about No. 3 i.w.g. to No. 20 i.w.g. Generally, the best Swedish steel is used, this having a high tensile strength and an original tenacity of between 25 tons and 30 tons per square inch. This strength is reduced somewhat in working, but, except with the very thinnest tubes, the tenacity may be taken as at least 10 tons per square inch; thus a tube of 12 i.w.g.

and 12 in external diameter may have a tensile strength of nearly 3 tons, with a bursting strength of nearly 900 lb., although in actual working about 100 lb. to the square inch would be quite enough load with water steadily applied. Drawn, weldless tubing is said to be far cheaper than the commonest gas tubing.

Setting Degart or Carriage Axles.—Figs. 1 and 2 show a pair of dogcart wheels standing vertically to the under plumb spoke, which is parallel to the lines B B. If the spokes are face-lined with iron stock, as in a Warner patent wheel, then all spokes are equal and parallel; but if a staggered or dodged spoke wheel is being set, the spokes will be parallel, but not plumb. They will be half the difference of the dodge out of the plumb in each spoke when set to a back and front spoke. Some wheelwrights set their wheels to a front spoke only, but this is hardly right, as the weight is then thrown irregularly over the wheel. The spokes across



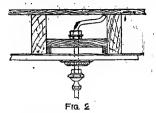
Setting Axle.

the lines B B having been set parallel, the top diagonals of the wheel span should be lined true in the direction of 1, 2, 3, and 4 (Fig. 3). Then the wheels should be set parallel in their horizontal diameters as in the plam (Fig. 4) across the lines diagonally as at s s and D D, and should then be perfectly square. Many men set their axles with gather, both in the plumb spokes and in the front cross centre line of the wheels; this they argue to be necessary to allow for the axle springing in the centre from the weight, and from the wheels coming in contact with obstacles in front whilst travelling over rough roads. However, if an axle gives at all, it is not strong enough for its work, and ought not to have been used.

Applying Lead Enamel to Iron.—By Dormoy's mechanical process the iron is heated to redness and placed in a double hermetically sealed chamber having glazed sides; each half of the chamber can be worked alternately, and the surplus enamel powder, sifted over the iron, is removed from the chamber by a draught from a high chimney. The iron is moved as may be necessary from outside the chamber, and the sleves which distribute the powdered enamel are vibrated by electrical means.

Fixing Gas Pendants.—In fixing pendants, it is often found that a rose or centre-piece has been fixed on the ceiling, and consequently the exact position for the hanging light is defined; but when the gas pipes are being laid in, when the carcase of the house only has been finished, the gas-fitter can decide for himself the exact centre of the ceiling. When this comes close to a joist the fixing of a pendant or chandelier, as it is sometimes wrongly called, is easy. Most pendants have, and all should have, a ball and socket joint. This joint enables the pendant to swing in any direction, either to be held out of the way or, in the event of a knock, to allow of a movement of the pendant without it loosening, and perhaps breaking the joints or pipes composing it, the joint at the same time preventing any escape of gas. Each end of the hall and socket joint is usually fitted with a female or internal thread, so that the pipe from the pendant can be screwed into one end, and a short piece of pipe, to pass through the ceiling, into the other (Fig. 1). This short piece of pipe should be of sufficient length to reach a tee on the pipe running across the joists, thus connecting the pendant to the gas supply, and also, at the same time, serving to carry the weight of the pendant, the supply pipe being carried beyond the tee with a short piece of pipe, duly capped off, which will lie upon the next joist, and so form a double means of support. Should the iron supply pipe be running in the same direction as the joists, the best method to adopt is to fix what is known as a bridge-piece between the joists, and the simplest manner of





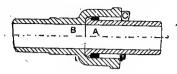
Gas Pendants.

doing this is to nail a narrow strip of wood to each joist, and rest the ends of the bridge-piece upon them as shown in Fig. 2. In the exact position over the hole in the ceiling, a hole should be drilled, through which the short piece of pipe from the ball and socket joint can pass, but it should fit it fairly closely, and if a long thread be put upon the npper end of the pipe, a back-nut can be put on before the union of the cap and lining is screwed on; the back-nut should then be turned back until it forms a guard to the union, which will not only prevent the latter unscrewing, but will also keep itself in the right position (see Fig. 2). The ball and socket joint should be taken to pieces in the shop, well greased with tallow at the movable joint, and if found leaky a little powdered emery should be ground in. When finished, it should be carefully cleaned off, and a fresh greasing with tallow laid on, and the whole put together again and tested. Very iew firms supply their fittings of such quality as to be always tight, but good firms are to be found who test all their fittings most carefully before sending them out for sale.

"Flashing" Glow-lamp Filament.—This operation consists in depositing carbon on the filament so as to improve the surface and give the filament the right resistance. It is done by heating the filament to a white heat in benzine vapour by passing an alternating current through it. The operation is stopped when the resistance of the filament, cold, has reached a certain value. A generator of henzine vapour and a bell jar hang from the ceiling with a counterweight, and on a table below the bell jar the ends of the filament are clamped to a couple of metallic uprights. By means of a double-throw two-pole switch, these uprights can be put in circuit with an alternating current generator, or in one arm of a Wheatstone bridge which has equal fixed resistance in the other arms. The operator sees no part of the bridge, except the galvanometer. When the filament is in place the bell jar is lowered over it, and filled with benzine vapour: The double-throw switch is then thrown in the alternator circuit, and the filament beated to whiteness by the current. The benzine vapour is decomposed, and the liberated carbon is deposited on the filament, which thus becomes thicker, and hence a better conductor. This is continued for a few seconds, when the switch is thrown over to the "Bridge" circuit, and the galvanometer observed. If the needle deflects towards the word "Flash," the switch is thrown over to the

until, on putting the switch over to the bridge circuit, the galvanometer needle does not show deflection at all. This indicates that the resistance of the filament is equal to each of the resistances in the other arms of the bridge. A continuous current cannot be used for flashing, as it would bend the filament out of shape.

Jointing Spigot and Socket Pipes.—The method of jointing spigot and socket ends is here shown, the spigot end at one pipe being inserted in the socket end at of the other. Having set the pipes to the required level, the end of a should then be so packed as to leave an equal space all round between it and B. This, of course, cannot always be done when rounding a curve, as in that case one side of the joint may be narrower than the other. Then drive in two or three layers of jute or yarn with a long caulking tool. This should take up about one-third the depth of the socket space. Now place a roll of tough clay around the joint, forming the iwo ends into a lip c at the top, as clearly shown in the illustration in section, and, this having been made secure all round by pressing it firmly to the pipe and socket with the fingers, the joint is ready for filling. For this a ladle must be used that will held at least enough for one joint. Take care to have the lead hot enough, and to warm the ladle before putting it in the metal-pot. As soon as the metal is poured and the joint caulked. A lead joint will always run spongy near the runner or lip, and for this reason the lump of lead formed in the clay lip should not be cut off until the joint has been canlked, as it is necessary to drive in more lead at that particular place to ensure a sound joint. In laying Jointing Spigot and Socket Pipes.-The method of



Pine Joints.

mains where much jointing is required, it is usual to mains where much jointing is required, it is usual to fix up four, five, or six joints (according to size) with the clay round ready for running, and then run all together. This is the best way if there is a workman following with the canking tools. In going round a curve, where set may be required in each joint, a good way is to place the pipe straight until the yarn is in, then pull them over to the required curve before finishing the joint with the clay.

Electrical Extraction of Sugar.—For the electrical extraction of sugar varied materials, such as wood pulp, peat, fruits, clay, sludge, and bectroots, are used as a diaphragm between a perforated cylindrical cathode and an interior concentric anode, also perforated, an intermediate helical blade advancing the material and breaking up surface crusts. By another process the materials, comminuted beets or cane, are packed between a copper-wire cloth cathode and a filter-cloth diaphragm mounted on opposite sides of a box frame. The anode of zinc, aluminium, or other metal capable of forming insoluble salts with the acids of the crude sugar solution, is placed in water in a compartment exterior to the diaphragm, and into this compartment water is led from the top to replace that evacuated from the cathode. The current electrolyses the dissociable ealts, the anions uniting with the zinc or aluminium bases, together with the non-electrolytes—sugars and soluble albumens—pass out with the water through the cathode to the trough. cathode to the trough.

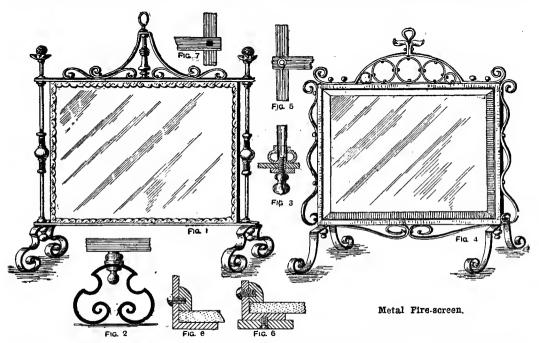
Sterilising of Sponges.—This may be accomplished by immersion for twenty-four hours in an 8 per cent. hydrochloric acid solution, which eliminates lime and coarse impurities; then wash the sponges in clean water, and immerse for from five to twenty minutes in a solution of 10 grammes of caustic potash and 10 grammes of tannin in 1 litre of water. Then wash in sterilised water or in a solution of carholic acid or sublimate to remove the brown colour left by the tannin. The sterilised sponges should be kept in a carbolic solution until required for use.

Preservative for Wooden Casks.—To preserve wooden casks from putrefaction and from insect ravages, a composition may be made by meiting together 16 parts by weight of ballow, 2 parts of yellow wax, 3 parts of colophony, 3 parts of vitreous sand, 1 part of arsenic, and a small quantity of a suitable pigment. Two coats are needed of the preservative, which should be used cautiously, as it is poisonous.

Preparing Hemp for Rope-making.—The bales of hemp (most often Manlia, but sometimes sisal) are opened in the basement of the mill, and the material is shaken apart lightly, and then placed in layers, which are sprinkled lightly with oil to soften and lubricate the fibres previous to their passage through the machinery. Then the hemp is passage over roughing eylinders bristling with sharp steel prongs or teeth, which straighten out the fibres and remove the tow and fine broken particles, dirt, or other foreign substance. It passes to the breakers, these being frames about 25 ft. long, consisting of two endless chains studded with steel pins. The first chain runs slowly, and feeds the fibres to the second one, which runs much faster, the effect being to comb or straighten out the fibres and draw them into a sliver or ribbon. The hemp is hoisted on elevators to the top of the huilding, and is then passed through the spreaders and drawing frames, which resemble the breakers, except that they are smaller and furnished with steel pins and teeth of gradually increasing fineness; these still further comb and straighten out the fibres, a number of slivers being put together behind each machine and drawn down to

separated according to quality, and then shipped in bales. From 150 to 200 trees produce only 140 lh. of fibre. Sisal hemp is the product of the agave, a large, fisshy-leaved plant found chiefly in Mexico and Yucatan. The yellowish-white fibre is straight, emooth, and clean, but its strength is 25 per cent. less than that of Manila hemp.

Fire-screens in Metalwork. — Fire-screens into which pictures on glass may be introduced are shown by Figs. 1 and 4. Fire-screens may have a glass painting of flowers, landscape, etc., and are ornaments that cover the usually black fireplace. The design shown in Fig. 1 may be made either in brass or copper, and can be constructed by an ordinary mechanic. The size of the screen will vary according to taste, or according to the size of the painted glass or plate. The feet (Fig. 2) should be of cast brass or copper, a pattern being made in wood, and then cast. The side standards are of brass or copper tubing, say § in. in diameter, having cast caps and bases, into which the tubes fit. These caps and bases, as shown in Fig. 3, have solid bottoms, thick enough to take a screwed pin, which for the bottom



one sliver again at the end of each machine. The drawing is repeated over and over again in order to make the sliver even, without which it would be impossible to spin fine, even yarn. The material emerges from the "finisher," the finest drawing frame of all, in the form of small, soft ribbons, in readiness for spinning the actual rope.

Materials for Rope-making—In American practice the materials used for making ropes include hemp, flax, manila, sisal, jute, and other vegetable fibres. Yucatan sisal and East Indian jute are much used for cheap rope and for binder twine. Russlan and American hemp are preferred for standing rigging, owing to their ability to absorb a large quantity of tar. Manila hemp is used more than any other material because it is very pliable and strong; it is obtained from a species of wild plantain belonging to the banana family, and is a native of the Philippine Islands. Its dark green, smooth stem is from 15 ft. to 20 ft. high, and the fibres are round, silky-looking, white, and lustrous, easily separated, stiff, very tenacious, and very light; they are weak transversely, but in the direction of their length the tensile strength averages more than 30,000 lb. per square inch of section. The plantain is cut near the roots when from two to four years old, and the leaves are cut off just below their expansion. The outer leaf la stripped off, the fibrous coats are left in the shade to dry for a day or two, and then divided lengthwise into strips 3 in. wide. These are scraped with a bamboo instrument until only the fibres remain, and bundles of these are shaped into separate threads, washed, dried.

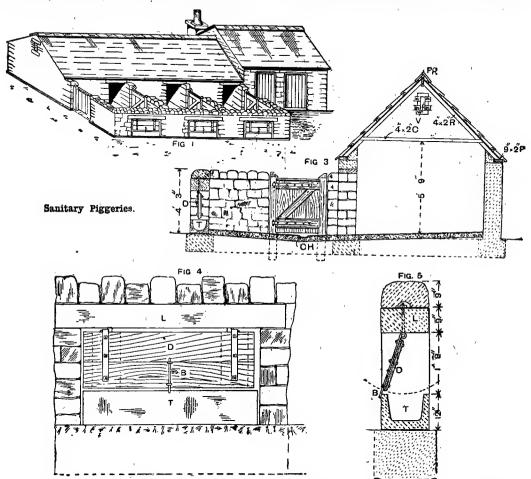
must be of square section in the centre to fit into a square hole to prevent the leg moving round (see Fig. 7). The top one on which the knob screws may be a screw pin only. The two standards thus made are fastened together by two flat brass bars (Fig. 5) or tubes. A turned brass central pillar is screwed to the top brass bar, and scrolls are made in brass strip, ½ in. by ½ in. thick, and secured by round-headed screws to the top bar, and by a ring knob to the centre turned pillar. The frame to hold the glass or picture is constructed of angle brass, soldered at the corners, and fastened to the frame with screws. The glass or picture is secured in this frame by a strip of wood fixed to it with screws, as shown in Fig. 6. The outer edge of the frame may be cut into scallop pattern, or left plain if preferred. After being fitted, the brass or copper frame should be polished and lacquered or bronzed. Fig. 4 shows a fire-screen constructed of wrought-iron. This form could be made by anyone skilled in working in wrought-iron. The frame is made of ½-in. angle-iron, brazed at the corners, and fitted with a wood strip, fixed with screws to hold the glass in place, as shown at Fig. 8. The legs are of flat iron, 1 in. by ½ in., and are fixed to the under side of the frame with screw pins. The ornamental scrolls at the sides of the frame and at the top are made of iron, ½ in. by ½ in. thick, riveted together, and fastened to the iron frame with round-headed screws. The ornamental place in the top may have a running scroll pattern, if preferred to the rings shown. When completed, the frame may be enamelled any colour to taste, or may be painted dead black, in the latter case any copper ornaments showing up to advantage.

Pumicestone Scaps.—These are produced by the cold process. One method is to melt 400 parts (by weight) of cocoa-nut oil and 100 parts of cotton oil, and stir in 240 parts of caustic sods lye (38° B.) and 10 parts of caustic potash lye (30° B.), both the lyes having a temperature of from 32° C. to 55° C. (89 88 F. to 95° F.). Sitt in 250 parts of pumice powder, and to scent the soap mix in 1½ parts of cassia oil, 1 part of rosemary oil, ½ part of lavender oil, ½ part of safrol, and ½ part of clove oil.

Preparation of Boiled Linseed Oil.—There are practically two methods of preparing boiled linseed oil:
(1) By boiling with open fires, and (2) by heating with steam. In the older method, by an open fire, the raw linseed oil, after it has been stored in tanks for a suffi-

constantly stirred with a paddle-shaped stirrer to prevent it from burning at the bottom of the pan. After about half an hour's boiling the addition of driers is commenced. These are added in small portions at a time, the total quantity heing about 4 lb. or 5 lb. per ton of oil; after the last addition of driers the boiling is continued for about an bour longer; the fire is them put out, and the oil pan covered up and allowed to stand till the next morning. In the morning the skin is removed from the surface, and the oil run into the storage tanks.

Sanitary Piggeries.—Sties and piggeries are not allowable in close proximity to dwelling houses; but local bye-laws differ as to the distance by which a sty shall be separated from the dwelling. When pigs are



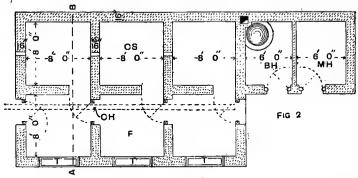
cient time to allow the impurities to subside, and in some cases after chemical treatment, is run into the boiling pan. The boiling pan is usually made of boiler plates riveted together, and is cylindrical in form, with a rounded bottom; it is set in brickwork in a similar manner to a washing copper, and provided with a fire-place beneath, the stoking hole being outside the boiling shed, in order to minimise the risk of fire. A bood placed over the pan conveys the fumes to a chimney. The capacity of the boiling pan varies, according to the size of the works, from 100 gal. to 1,000 gal. or about to 4 tons. The pan being about two-thirds full, the fire is lighted, and, as the heat rises, frothing of the oil commences, and, as far as possible, this is kept down by beating it with a switch, or by removing some of the oil in a scoop and allowing it to fall from a height; should this measure be unsuccessful, the fire must be damped down, or the oil may boil over. After the preliminary frothing, due to the escape of water, the oil begins to boil quietly, and it will be found that the temperature has risen to about 500° F. The oil is kept

suitably housed and properly cared for, the odour arising from them is considerably lessened. Plggerles should be built on high ground and on the east side of a dwelling, and the drainage from them should flow away in an opposite direction to that of the dwelling. Fig. 1 is a general view of a range of buildings, the cost of which would be from £60 to £70. Fig. 2 is a ground plan, Fig. 3 a section on line A B (Fig. 2). The buildings comprise three sties C S, with forecourts F; a boiler-house B H, and meal-house M H, being attached. The remaining figures show details of construction which will be further referred to. The walls of the buildings here shown are of local stone, on proper foundations 1 it. 8 in. wide and 1 it. deep, and are 16 in. thick. They are pointed on both sides, and a ventilator V should be formed in the gable end of the stles as shown in Figs. 1 and 5. Penman stone feeding troughs T are fixed in the front walls, and over each trough a swinging flap D, fitted with a special both a as shown in Fig. 4, Is hung from an oak or a stone lintel L built in over the opening; this arrangement is shown

in larger detail, both in elevation (Fig. 4) and in section (Fig. 5). Elm board is suitable for the flaps, which are 1 ft. 9 in. wide, and of sufficient length to clear the opening. Joints in the flooring of piggeries should be avoided, and the flooring should consist of some impervious material, such as concrete finished off with Portland cement and sharp sand in the proportions of 1 to 3, laid with a fall towards a channel C H, which, as shown by the dotted lines in Fig. 2, continues in line through all the sties, so as to conduct the urine to a cesspit from which it may be dipped out. The roof of the sleeping compartment C s of the sties should be formed of 4-in. by 2-in. rafters R, with collars C of similar size, on a 9-in. by 2-in. plate P, and be covered with Roman tiles, with plain pointed ridge P R set in cement, which lie close, forming a covering that is cool in summer and moderately warm in winter. Where home-grown Scotch

sumption of gas is concerned. It has also been stated that the explosive tendency of acctylene is reduced materially by the new method. The diluted gas is well adapted for running gas engines, for which purpose pure acctylene has not been considered economical.

Staining Old Oak Furniture.—Whilst making repairs, it will rarely be possible to match the original wood in colour. The use of stains is therefore not to be avoided, and perhaps the stain most in favour with the ordinary restorer is permanganate or bichromate of potash—loz. of either to l qt. of rainwater. The potash stain has the advantage of being applied with little trouble. The rich colour of old oak would seem to be owing to the tannin in the wood having been acted on during a long series of years by the ammonia in the atmosphere. Artificial fuming is therefore carrying out



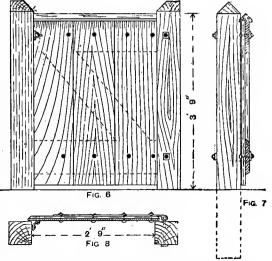
Sanitary Piggeries.

fir is abundant, a layer of 2-in. boarding under the tiles will be an improvement. Ledged and braced hatches of 1-in. unwrought elm, with 6-in. by 6-in. oak posts, as shown in elevation, section, and plan, with figured dimensions, in Figs. 6, 7, and 8, respectively, are as suitable for piggeries as more expensive doors; but they should be fitted with a grooved deal capping to throw off the wet.

Uses of Graphite.—About 55 per cent. of the total production of graphite is said to be employed in making crucibles; 15 per cent. for stove polish; 10 per cent. for lubricants; and the remaining 10 per cent. includes lead pencils and all other applications. Half of the world's total output of graphite is of the crystalline kind, and the rest of the amorphons kind. The uses to which it is put depend largely on certain of its physical characteristics, none of its uses, except as a foundry facing, involving any chemical reaction.

characteristics, none of its uses, except as a loundry facing, involving any chemical reaction.

Diution of Acetylene Gas.—The main object of diluting acetylene gas is to cheapen the employment of the gas. A well-known process is to mix it with such gases as carbonic acid, nitrogen, etc., but these ingredients not only unfavourably affect the illuminating power but also greatly increase the products of combustion, thus deteriorating the atmosphere much more than pure acetylene does. It has also been attempted to dilute acetylene with combustible gases, but with ordinary illuminating gas a gas-house is necessary, and if carburetted air is used, a gas generator equipped with motor and weights is required; besides, the presence of air increases the explosiveness of the acetylene gas. Attempts made to dilute acetylene with alcohol vapour have not been successful because by the cold method the alcohols are so little gasifiable by acetylene. One process is to dilute the gas with hydrocarbon vapour given off by such volatile substances as petroleum, ether, petrol spirit, etc., the diluent itself in this case being a light-giving and heat-giving vapour gas. The purified acetylene is conducted to a vessel nearly filled with the hydrocarbon, the gas entering at the bottom, bubbling up through the oil or spirit, and passing off, laden with vapour, at the top. Another method is to pass the acetylene rapidly through a porous body saturated with the hydrocarbon. The admixture renders possible the use of the gas in incandescent burners, hitherto impracticable on a large scale owing to the large deposits of acetylene black on the mantle and burner and to the great liability of lighting back. It is, indeed, extremely doubtful whether the dilution with hydrocarbon vapour remedies the second defect. Illumination with mantle costs only half as much per candle-power as do former methods of lighting with acetylene, as far as the con-

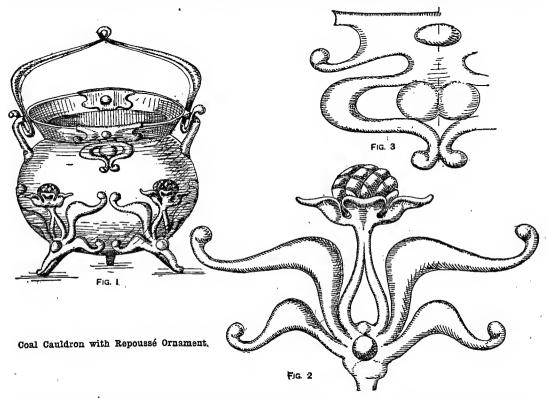


nature's own system of staining, but with more rapidity. For this operation it is necessary to have an airtight chamber large enough to hold the work to be coloured. One may be made by pasting paper all over a packing-case, giving especial care to all joints and cracks. The liquid ammonia, which should be of 880 specific gravity, is poured into a number of shallow pans placed on the floor of the chamber. A pint is sufficient for a chamber of 150 cub. It. capacity. The wood is put in, and the lid so papered down that no escape can take place. It may be left for twenty-four hours or more, according to the depth of colour required. Such an apparatus is also nseful for fumigating wood-grub with sulphur. Possibly old newly wrought wood or fumed wood may be less deep in colour than the surface they have to match, but it will be a simple matter to bring them right with iron-wash. Iron-wash is made by pouring vinegar on any scrap iron, which after a few hours will produce a liquid capable of staining oak to the very deepest shade. But this wash is useless for ordinary new wood, as it gives an unnatural purplish tinge; old or fumed wood, however, it deepens to a rich brown. Thus used, an iron-wash, sufficiently diluted, will tint new parts to the most exact accordance with the old.

Fitting Take-up Cam to Sewing Machine.—These hints on fitting a new take-up cam apply to more modern machines, as the old style take-up lever is actuated generally by the needle-bar; but in machines having a rotary or reciprocating shuttle the take-up lever has a varied motion made by a grooved cam. These cams, if of cast-iron, are liable to become worn very much in one place, hence the need for a new cam. Some cams are held in position by spot-screws, and are therefore easily replaced, care heing only required to put the spot-screw in the right hole; other cams are held in position by means of taper pins. First take out the parts necessary to remove the old cam; place a mark on the shaft to indicate the large end of the pin; fit the cam on the shaft (not too easily), replace the other fittings, and prepare for timing the machine. When the action of the shuttle is oscillating, put the shuttle carrier at its most backward position—viz. where it is just about to move towards the needle—then place the take-up cam so that the needle-bar rises slightly (not

old style machines the needle rises as much as a in, but when it has done that it remains stationary until the shuttle has sufficiently entered the loop, whilst in modern machines the action of the needle-bar is continuous, and the shuttle must act accordingly.

Coal Cauldron with Repoussé Ornament.—The antique-looking metal coal box illustrated in Fig. 1 can be made by utilising one of the cast-iron cauldrons that may be purchased from any ironmonger at a small cost. It should be selected with an opening about 1 ft. in diameter, and as smooth in the casting as possible. This should he rubbed all over with stone or brick, and then with emery cloth, so that it may have a smooth surface, and is then ready for the ornaments (Figs. 2 and 3). It has east on it two arms, one on each side, connecting the rim to the body, and these will be utilised in fitting the handle. This may be of wrought-iron or copper, and is shown enlarged at Fig. 4. If in wrought-iron it may be forged from square iron, drawn



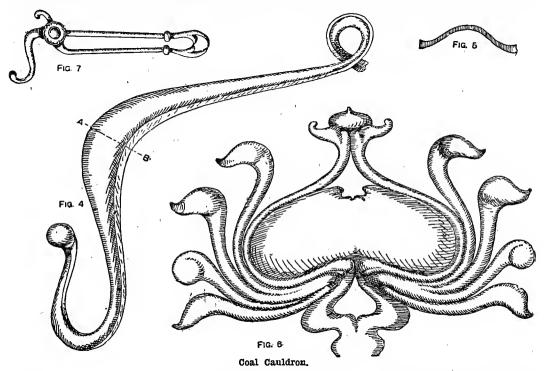
more than $\frac{1}{37}$ in.), secure it by a set-screw, and reamer the hole to fit the pin. The hole is generally drilled in the cam at about the right position and simply needs reamering out, but in some cases the holes in the cam and shaft may not correspond. In such a case remove the cam and shaft, plug up the shaft-hole with a piece of steel wire, braze it, and then clean it off, replace it in the machine, set the cam as already instructed, and drill it in this position. If the action of the hook is rotary, allow the needle-bar to rise from $\frac{1}{37}$ in. to $\frac{1}{3}$ in. In this position. Some shuttle carriers or drivers are held in position by screws, others by taper pins, and exactly the same rule applies. The needle and the shuttle must have their correct relative time, whether rotary or oscillating, as before described. By the time of a machine is meant the exact movement of the needle with relation to the shuttle, so that a loop is formed in time for the shuttle to enter it. This varies somewhat, according to the class of material being worked. As a general rule, for modern machines, either rotary or reciprocating, allow the needle to rise from $\frac{1}{3}$ in. to $\frac{1}{3}$ in. before the point of the needle reaches it; but when the goods are heavy it will be found necessary sometimes to make the shuttle slower, and lower the needle-bar to compensate for this. If the general rule does not apply, time the needle, throwing a bold loop, and letting the shuttle just enter it when it is fully made. In some

out at each end to form the hooks, and hammered in the centre to a flat curve, as shown at Fig. 5, which is a section on A B (Fig. 4). In the centre a ring is formed by twisting the thin portion. If the handle is made in copper, prepare a wood pattern of half the handle; then make two castings, and hard solder them together in the centre at the ring junction. The hooks at the ends of the handle will clip the arms on the cauldron. The outer surface of the cauldron should next be ornamented with bright metal. Copper or brass sheet of, say, No. 17 or No. 18 B.W.G. should be cut out to the pattern, the bottom being left long enough to cover the face side of the short legs of the cauldron. These plates should be made bright, and then repoussed, as shown in Fig. 2. Three of these ornaments will be required, one over each leg of the cauldron, and between them, but on the rim of the cauldron, should be affixed the designs shown on Fig. 3. These should be turned over so as to clip the top, and thus decorate the rim inside and outside. To fix these plates to the cauldron, small holes should be drilled in the metal for screws and nuis. The plates require a little setting to fit the sides of the vessel, and this may be executed with a wood mallet or a piece of soft wood. When fitted, the ornaments should he removed, polished, and lacquered, and the cauldron enamelled dead black, with egg-shell finish. On this the brass or copper ornaments will look well. Or, if preferred, the cauldron may be painted any colour with

enamel paint. Fig. 6 gives an alternative pattern for the repoussé work of the lower portion of the cauldron, and Fig. 7 illustrates a suitable pair of tongs. These may be executed in wrought-iron, the rose covering the joint being of polished copper. The handle is shown of hook form, so that it may fix itself over the upper rim of the oauldron and be secure. These tongs should be made of best iron, $\frac{1}{12}$ in. round, flattened out to a boss to form the joint, a turned circular pin passing through the centre, and being secured by the two copper roses. The lower ends are forked to hold the coal, and the tongs should have two coats of dead black.

European Soft Woods and Their Uses.—Northern pine, commonly known as red or yellow neal, is obtained from a tree known to botanists as Pinus sylvestris, which thrives best in Northern Europe. The colour of the wood varies from pale- to deep-reddish yellow. As a rule, the closer the annual rings, the better the quality of the wood; the spring and autumn layers being distinct. When of good quality, it is one of the easiest woods to work, has a pleasant resinous odour, is fairly free from knots, sap, or other defects; and, if thoroughly seasoned before use, is extremely durable; whilst, being

lasting of the coniferous woods, is very strong and tough, but shrinks and warps much until properly seasoned. The best wood is fairly free from knots, is straight and even in grain, and bears nails heing driven into it better than any other soft wood. Owing to its withstanding wear well, it is suitable for stair treads, flooring, etc.; and hecause of its lasting properties it is a valuable wood for railway sleepers, posts, fences, and other exposed work. Silver Fir (Pinus picea) has only been used to a small extent in England—principally for floors—although on the Continent it has been largely used both for carpentry and joinery. It is light, elastic, stiff, and strong. Cluster Pine (Pinus pinaster) somewhat resembles yellow deal, although rougher and having a greater number of large knots. It is very seldom used in England for building purposes; but in France it is much used for rough carpentry and for shipbuilding. Being very durable in water, it is most suitable for piles, etc. The Yew tree (Taxus baccata) attains a great age, and its timber is close and fine in grain, flexible, and elastic. It is considered one of the most durable woods, and is therefore very suitable for flood-gates, posts, fences, and for use wherever great lasting properties are required. This timber has only



fairly flexible and elastic, it will not snap suddenly and without warning under a load. The wood is plentiful, and its many valuable properties render it one of the most valuable varieties for almost every ordinary purpose of carpeutry and joinery. White deal, also known as white fir and spruce deal, is from a tree botanically termed Ables excelsa, which thrives in the same districts as the Pinus sylvestris. The annual rings are distinct; the autumn layer, containing less resinous matter than red deal, is not so deep in colour, being inclined to a brownish tint. This timber often contains a large number of hard glossy knots, which frequently are so hard as to notch or turn the edge of a plane iron. Upon being wrought, the surfaces show a silky lustre. One peculiar characteristic of this wood is that the sapwood cannot be distinguished from the heartwood. It is unsuitable for independent pieces of joinery, such as doors, etc., as it is very liable to warp unless restrained; it shrinks very little, however, and is therefore frequently used for panels of ordinary joinery; and, for the same reason, because it retains a clean light colour; it is very often used for the tops of dressers and tables, for shelves, and for upper floors. It is not durable for external work; but the stems of the younger trees, growing fairly straight, are largely used for scaffold poles and the sides of ladders. Larch (Larix europea) is considered to be one of the nost

a small proportion of sapwood, which is white, hard, and fairly durable. The heartwood is generally orange colour or rich brown. Yew, on account of its scarcity, is generally employed for cabinet work only, and then largely in the form of veneers. The Cypress (Cupressus sempervirons) thrives in Southern Europe, and the durability of its wood is almost unrivalled; most of the ancient coffins containing Egyptian mummies are of this wood, and its strong odour is repugnant to worms and insects. It is very suitable for building purposes, for which it is largely used in and near the districts in which it grows, but seldom or never in England.

Oil for Farm and Team Harness.—To make this

Oil for Farm and Team Harness.—To make this, melt 3 lb. of pure tallow without letting it boil and gently add 1 lb. of pure neatsfoot oil. Sir continually until cold, so that it will be perfectly mixed, otherwise the tallow will harden in lumps. To colour, add a little bone black.

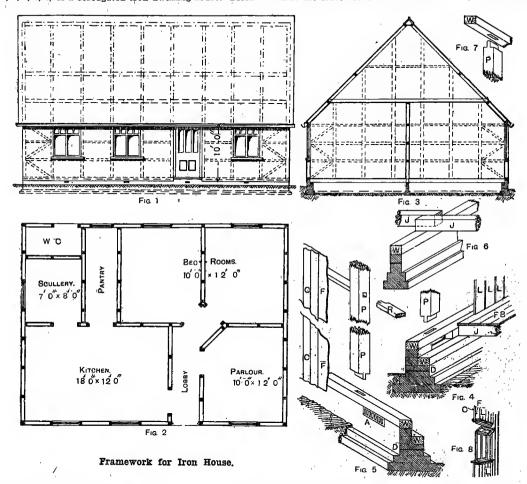
Influence of Hydrogen on Iron.—Red-hot iron acted upon by hydrogen is affected considerably. Plunged into the gas and then cooled in water, the iron became very brittle, and brittleness is especially noticeable in cold bending. The iron loses part or the whole of its brittleness on being slightly heated in an oil-bath or water-bath, or on being left in the open air at the ordinary temperature.

Properties of Graphite.—The principal properties of graphite are infusibility at temperatures below that of the electric arc, great capacity for absorbing and transferring heat, comparatively high electrical conductivity, and that peculiar softness which allows of yielding by contact with other surfaces, and which is the reason for the use of graphite in lead pencils, lubricants, and polishes. It readily adheres to any surface, and is polished by the slightest friction.

Framework for Iron House.—When planning an iron house, it is necessary to bear in mind that corrugated iron is made in sheets of standard size; the sheets are 10 ft. by 4 ft., and the half-sheets are 10 ft. by 2 ft. The accompanying figures show the elevation (Fig. 1), plan (Fig. 2), section (Fig. 3), and details (Figs. 4, 5, 6, 7, 8) of a corrugated iron dwelling-house. Brick-

felt F being first tacked on to the framework. No fireplaces are shown, as gas stoves are recommended; if the latter are not available, it will be necessary to construct fireplaces in brickwork, and no woodwork should be within at least 9 in. of the flue. Air grids a should be inserted to ventilate the space below the door, and damp-proof courses D should be laid in the brickwork.

Advantages of Weldless Chains.— First, the material being steel, and there being an absence of welds, the chain is much stronger than the common welded chain. Then the link can be made of any shape by means of dies. The weak point of a chain is the part of the link bearing on its neighbour; and when the chain is pulled, that part is subjected to bending stress, while the sides are under tension. Hence, to make the



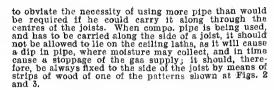
work footings are first constructed, and on these the wall-plates w are laid; the uprights or posts P are tenoned into the wall-plates as shown. Allowing for a 4-in. lap, the uprights P must be fixed at the standard distance from each other of 3 ft. 8 in. centre to centre; the helght from the ground to the eaves must he such as to allow of the iron sheet being fixed without cutting; this will be about 10 ft. The uprights or posts P are 3½ in. by 3½ in., or 4 in. by 4 in., and between them are tenoned the rails R; the rails assist in steadying the posts, and to them also the matchboard lining L is fastened. The windows are made of such a width as to fit in exactly between the posts. The joists J are 4½ in. by 3 in., and rest on the wall-plates W, and they are also supported where necessary by sleeper walls not shown in the illustration). The floor boarding F B is 1½ in., grooved, and put together with hoop-iron tongues. The lining L is 3-in. rebated, V-jointed matchboarding, stained and varnished. The corrugated iron C is screwed or nailed on to the outside, a layer of

link of uniform strength throughout, the ends should have a larger sectional area than the sides, bendling being much more severe at the ends. This enlargement is accomplished in the weldless chains. Welds in a handmade chain reduce the strength by from 10 to 40 per cent., the average reduction being about 20 per cent.

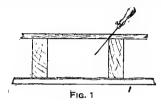
Light Guards for Machine Tools.—Guards are generally of cast-iron, but for heavy wheels castings are too heavy, and sheet metal is a good substitute. In skilled hands guards of this kind improve the appearance of a tool, besides being efficient in every way, being lighter than cast-iron, and not liable to damage in transit, whilst they can be made in halves and botted to the machine, where they make a good fence as well as preventing the splashing of oil from gears. Wire guards had many advantages, being light, cheep, easily fixed, not obstructing light, and enabling the gears to be inspected by workmen and foremen alike. The mesh is too close to allow the fingers to be inserted.

White-lead Substitutes.—The white pigments which may be looked upon as substitutes for white-lead are Glasgow white, zinc white, Orr's white enamel (or Charlton white), Griffith's patent zinc white, and Freeman's white. All these pigments have one advantage over white-lead—that is, they are not so readily acted upon by sulphuretted hydrogen; therefore, if used in towns where foul gases are likely to be evolved, they do not so soon blacken; some of the substitutes do not change colour at all in situations where white-lead would rapidly become discoloured; zinc white, Orr's white, and Griffith's white, for instance, are not affected. White-lead has greater body and covering power than any of the other white pigments, none of the substitutes being quite equal to it in this respect, whilst some are rather poor in these qualities. Those substitutes containing sulphide of zinc discolour pigments containing copper or lead, owing to the formation of the sulphides of those metals. This defect is not shared by white-lead, though white-lead is itself discoloured by other pigments—cadmium sulphide, for instance.

Removing Floor-boards in Gasfitting, etc.—When the floor-boards are laid, the common method of finding which board is wanted to be removed is to use one of the long gimlets which should be in every gasfitter's bag, and to drive it up through the ceiling until the point shows through the boards in the room above. This shows the exact centre of the hole below if the gimlet has been kept perpendicular when drilling. To remove a board which has been laid down is a somewhat difficult matter, unless the proper method is followed, and that is to drive the nails right down into the joist by means of a carpenter's punch; the nails will not be required again, as the board should be fastened down



Hints on Using Glue.—The workman should never prepare more glue than can be used in a few days, as that freshly made is stronger than that which has been frequently remelted. Glue should always be made with clean water, and should be used as hot as possible and in a warm room. The pieces of wood to be joined should be warmed before putting together; they should be well fitted so as to get as little glue in the joint as possible; the glue should be well rubbed in with the brush or probbing the two pieces of wood together, and the joint should be made close by clamping, tying, or rubbing, so as to squeeze out all superfluous glue. The joint should be made as quickly as possible, and after the pieces are fixed they should remain in a warm place for at least twelve hours. If a joint is broken when it once commences to set, no amount of clamping will make a good job of it; the glue must all be cleaned off and the joint made again. When the wood is porous it will be of advantage to size the surface with some very weak glue. This will fill up the grain and prevent the glue from sinking into the wood when the joint is made. Before veneering, the panel to which the veneer is affixed should have the surface roughened with the toothing plane to form a kind of key for the glue. Great care should be taken that no dust, grease, or oil gets on the surfaces to be joined, or the glue will not hold. Some woods are naturally of a greasy nature. Take teals







Gasfitting.

after the work is done by screws, preferably of brass, and with brass countersink cups or washers, so that the screws may be easily removed should the floor-boards be required to be raised to allow of an examination of the gas-pipes underneath. When all the nails are driven in, the board can usually be removed without much difficulty, unless it runs the whole length of the room and under both skirtings, in which case there are two ways of proceeding. One way is to lever up the board from each side until a piece of iron pipe, or a hammer handle, is inserted under the board to be removed, and resting upon the boards on each side, and then with a saw cut through the board over the centre of a joist. If this cannot be seen, cutting through the old nail-holes will be sufficiently near the centre for the purpose. When the board has been out in two, either piece can be easily taken up. The other method is also useful when only a short piece of board is required to be removed, and it consists in cutting the board with a keyhole saw on a slope close to the joist, as shown in Fig. 1, so that when refixed the board cannot be tipped up, and nails can be put in on the slope into the portion of the board already fixed, and afterwards into the joist. Where the pipe runs the opposite way to the joists in the floor, the usual method to adopt is to cut a small groove in the joists sufficiently large to allow the pipe to lie in it and not be injured when the boards are nailed down over it. These grooves should never be cut deeper than necessary, and should always be cut as near the points of support of the joists as possible, so as not to weaken the beam more than necessary. The law of strains on wooden beams need not be entered on here; suffice it to point out that all parallel beams are stronger near the points of support than necessary, as the strain diminishes as the side approaches; but the cost of cutting the beams to the exact curve, and the consequent unevenness of the floor and celling, more than compensate for the value

for instance; if the wood is not thoroughly dry the glue will not set on it, but will peel off. Wood of a greasy nature should not be used where glued joints are employed, nor for veneering.

Ployed, nor for veneering.

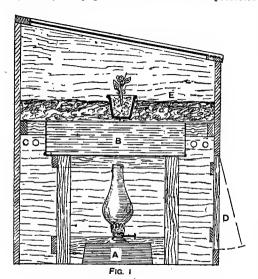
Brick Earths.—The earths employed in brick-making may be broadly divided into three classes: (1) Plastic or strong clays, commonly called by the brick-maker foul clays, and also known as pure clays. These clays are composed of silica and alumina, with only a small proportion of lime, magnesia, soda, or other salts. (2) Loams or mild clays, which consist of clay and aand, and are consequently often designated sandy clays. (3) Marls or calcareous clays, containing a large proportion of calcium carbonate (CaCq.). It frequently happens that a clay as found in nature is unfit for brick-making; it will probably be found that it is deficient in some necessary quality, and this has to be supplied by mixing it with other clays, or by adding the constituent lacking, such as sand or lime. A good brick earth should contain in itself sufficient flux to fuse its constituents at the temperature attainable in the klin, but not so much as to make the bricks run together and become vitrified. Such earths will contain from one-fifth to one-third alumina, and from one-half to three-fifths sillea, the remainder consisting of carbonate of lime, carbonate of magnesia, oxide od iron, etc. The bricks made from such clays are a compound of silicate of alumina and lime or other fluxes. The following is an analysis of a brick clay of average quality:—

| Silica | | | | | ••• | 49-44 |
|--------------|-----|-----|-----|-----|-----|--------|
| Alumina | | | | ••• | ••• | 34-26 |
| Ferric Oxide | | ••• | | ••• | ••• | 7.74 |
| Lime | •• | ••• | ••• | ••• | ••• | 1.48 |
| Magnesia | ••• | ••• | ••• | ••• | ••• | 5.14 |
| Alkalies | ••• | ••• | ••• | ••• | ••. | 1.04 |
| Water | ••• | ••• | ••• | ••• | ••• | 1.94 |
| | | | | | | 100.00 |

Flour Paste. -- Dissolve 3 oz. of alum in 1 qt. of water, by heat, and when cold add flour to the consistency of cream; then let the mixture boil, stirring it at the same time. By adding a little powdered resin and a clove or two before boiling, the paste will keep for a year and can be softened with water when dry.

Making Builder's Mortar.—Mortar is prepared either by hand or machinery. Machinery is preferable, as mixing the ingredients more evenly. Whichever process is adopted, it is necessary that the lime should be evenly distributed with the sand; unless this is attended to, a weak mortar will be the result even though the proper proportions may be present. The character of the water also plays an important part in mortar making; it should be clean, and only sufficient added to enable the lime to slake. Cold water is generally used, but hot water has been specified. Hot water is not beneficial in mortar making, for the reason that all limes (no matter what may be their chemical composition) contain in sufficient degree the heat necessary for the change which takes place during the slaking action, and extra heat introduced simply dries up the water that would otherwise have remained, and is necessary for the period hardening of lime mortar.

The Causes of Cracking in Concrete Walls.—
If the concrete be made of cement or time of varying quality, as may readily happen in different deliveries, the unequal character will cause a tendency to parting at the junction owing to their unequal rate of setting and unequal expansion when set. The same thing bappens if the cement, although uniform in composition, is not uniformly air-slaked before use, the fresher cement expanding more than that which has been properly prepared by being spread out on a wood floor protected

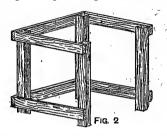


Propagator for Plants.

from the weather and turned over three or four times. The expansion varies from 0 to \(\frac{1}{2} \) in. per it., according to the amount of air-slaking it undergoes. Cracking may occur through original faults in mixing the materials to form cement. Over-liming gives high tensile strength on seven days' tests, but the free lime does not slake until the cement is partly set, and the consequent expansion is apt to disinfegrate the mass. Over-clayed cement is liable to contract, and has less tensile strength. The effect of magnesia in the cement has been variously estimated. When good Portland cement has been used in concrete for sea-walls, the magnesia found has been stated to come from the sea-water, the lime being slowly washed away and the magnesia deposited in its place, at the same time causing a general expansion of the exposed part and so flaking. If the cement he over-burnt, many hard particles will resist the grinding process, and only slake after much delay, when the general body of the work has set, causing blisters on the face of the work, which break off, and sometimes causing iractures in the mass. If slag be used for the aggregate, and any lime is contained in it, the same action may take place. In lime concrete, if the lime is not thoroughly slaked before using, the unslaked particles will cause local expansion when moisture reaches them, and ultimate fracture if they are in sufficient quantity. Fracture may also occur from want of cohesion due to imperfect mixing of the materials, or from an occasional overdose of water in the mixing, washing away the cement. If the concrete be exposed to the sun or to drying winds as it is deposited, and the

moisture be allowed to dry off too quickly, it will have a deleterious effect. If the concrete he mixed and deposited in frosty weather, or if a hard frost should set in after it is deposited, and while still "green" or imperfectly set, it is liable to cracking and partial disintegration. When concrete is thrown from a height into a trench there is a possibility of the heavier particles being separated from the others, disturbing the uniformity of the mass, and the shock also is apt to disturb the concrete below which has begun to set. It in ow the practice to lower the concrete into the trenches gradually, by shoots or otherwise. If the soil or supporting surface below the concrete into the trenches and of equal supporting power, settlements are likely to occur which will produce fractures in the mass. In forming concrete arches, or concrete paving in position, expansion boards or strips of wood are laid in, to permit of expansion or contraction without fracture by providing a weak place which can afterwards be grouted up. The same principle of localising the weak places has been adopted in the construction of some of the retaining walls on the Tottenham and Forest Gate Railway, vertical straight joints in the concrete mass being formed at regular intervals. Some persons assert that cracking is due to variation of temperature, or to expansion due to changes of temperature, unless provision is made to prevent it; but this is not certain.

Making Propagator for Plants.—For a propagator suitable for raising early batches of seeds and striking cuttings, etc., a lamp A (Fig. 1) must be made or procured first, as on it depends the height of the frame, etc. For a large propagator a duplex burner may be used, and the oil reservoir should hold about 1 qt.; but for a small propagator with a glass frame, measuring, say, 2 ft. 6 in. by 2 ft., a single-burner lamp will be sufficient. Next make a rough stand as shown in Fig. 2, with 1½-in. square legs and 2½-in. by 3-in. rails. The



top of this should be about 1½ in. above the lamp chimney. On the top of the stand is placed a shallow tank B (Fig. 1) to contain water. This may be about 18 in. square by from 2½ in. to 3 in. deep, and can be made of sheet copper, or, as a substitute, a square tin baking dish may be used. The case may next have attention, and this can be made of lin. matchboarding, or a baconbox may be made to serve as a substitute. The section of this is shown in Fig. 1, and a general view of the outside by Fig. 3. A ledge c (Fig. 1) is nailed round the inside, the top level with the top of the tank, and on this a sheet of iron is placed to form a bottom for the propagating chamber and a cover for the tank. The depth of the propagating chamber should be about 14 in. at the back and 9 in. at the front, which will make a total depth for the case of 1 ft. 6½ in. above the lamp chimney at the back and 1 ft. 1½ in. at the front. A doorway D (Figs. 1 and 3) may be cut through the bottom of the case on the side that may be most convenient, and can be fitted with a hinged shutter and with a turnbution or hook and eye, for the purpose of attending to the lamp. A few holes should be bored in the side of the case to allow the fumes from the lamp to escape, and it would be a good plan to let a small sheet of glass into the side, so that the lamp may be seen without pening the shutter. A layer of cocount fibre refuse E (Fig. 1) should be spread over the bottom of the propagating chamber, and into this the pots containing the cuttings or the seed pans are plunged. A couple of runners F (Fig. 3) are nailed to the sides of the case, and the top is covered with a sash such as is used for an ordinary garden frame.

Commercial Asbestos.—Commercial asbestos includes the classic and the target and the containing the shutter and a sash such as is used for an ordinary garden frame.

Commercial Asbestos.—Commercial asbestos includes two distinct minerals, which, though very similar in physical properties, are chemically distinct. One is a silicate of calcium and magnesium, and is a variety of mineral amphibole. There are a large number of the non-aluminous varieties of amphibole which pass into fibrous minerals, especially tremolite and actinolite, and all these fibrous substances are included as asbestos. The other mineral that is sold as asbestos is a variety

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of serpentine, a hydrons magnesium silicate known as chrysolite. The first substance placed on the market as asbestos was the silicate of calcium and magnesium, or amphibole, but as the chrysolite began to be used for the same purposes, it was placed on the market under the same name. These minerals are equally heator fire-resisting, but the chrysolite is superior in strength and elasticity of fibre, and is usually greenish-white, green, yellowish to brownish in colour, and has a decided silky lustre. The fibres are fexible, easily separated from each other, and have a sik-like appearance. The mineral is usually found in seams, of varying thickness, in serpentine rocks. The amphibole asbestos is usually of longer fibre than the chrysolite, is very flexible, and easily separated by the fingers. It does not possess the silky lustre found in the latter, but has the appearance of flax, with a colour varying from white to greenish and woody-brown. One of the chief chemical differences between the two forms is that the amphibole variety is an anhydrous mineral, whereas the serpentine or chrysolite is hydrous, containing from 12 to 14 per cent, of water.

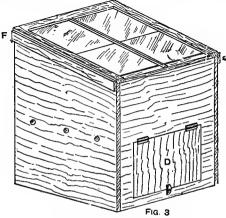
Spiriting out in French-polishing.—The object of

Spiriting out in French-polishing.—The object of spiriting out is to clear off the surplus oil left by the polish rubber, to increase the lustre, and to impart the final brightness. It is at this stage that many workers fail; they put on a good body of polish, but break up the surface and leave it dull in places. A new spirit rubber requires caution in the hands of the inexperienced, and only by constant use does it gain in solidity and usefulness. While a new rubber is soft it should also be firm to enable it to work out any marks left by the polish rubber; a soft one merely skims them over. The rag covering should be soft and of several thicknesses. However, excellent work may be done without the aid of a spirit rubber; in fact, the writer often uses plenty of clean rag instead of wadding. A fair-sized piece of clean soft rag should be folded into a swab or pad somewhat resembling the polish rubber and taken in the right hand. Then sprinkle it with spirits by means of a slot cut in the side of the cork, and, having made the pad fairly damp, not wet, put the bottle down and press the face of the pad against the palm of the left hand, to equalise the moisture. Then apply it to the work, lightly at first, but with a little firm (not beavy) pressure as the spirit dries out; repeat several times if necessary, changing the place in the rag should much oil be present. Methylated spirit is advised in preference to methylated finish, which must be adulterated with soft gum or resin; excess of this will prevent the work standing out bright.

Collection and Preparation of Lac.—Lac is collected from several Indian trees, upon which it is found as a kind of coating. It is formed by an insect, the lac insect (Coccus lacca), which punctures the bark of the twigs, and after absorption of the secretion redeposits it in a layer in which are imbedded the eggs of the insect. Lac occurs in commerce in several forms; stick lac consists of twigs enveloped with the lac, but this form is not used; seed lac consists of small grains; shellac occurs in thin orange-coloured leaves, more or less agglomerated; button lac is a darker kind occurring in irregular disc-shaped pieces; and garnet lac occurs in thick plates of a dark red colour. The different forms of lac enumerated above are prepared in India by native workmen with very rude appliances. The twigs containing the lac are collected from the trees and are beaten with a mallet, which dislodges the lac—the placed in a large vat along with water while the natives knead it about with their feet until most of the colouring matter, or lac dye, is removed. The lac is next placed in a coarse cloth bag, which is held at either end by two natives while it is exposed to the heat of a fire; below the bag is a small trough into which the melted lac from the bag collects. A third native ladles out the melted lac and pours it over a roller covered with brass, which is cansed to revolve, and thereby forms the lac into thin sheets; this is the shellac. Button lac and garnet lac are the more impure portions melted and poured on to a very dark garnet red; it is transparent in thin films and very brittle. Lac dissolves to a large extent in methylated spirit and turpentine; it is the basis of most of the spirit varnishes.

Forest of Dean Stone for Monumental Work.—Quite the finest of our English stones for monumental purposes is the Forest of Dean stone, commonly spoken of as Forest stone. In character it is a hard sandstone or grift. In colour it is either of a bluish or of a brownish grey, both of which are often to be seen in the same slab; but for making fine monumental work the blue is to be chosen. It is, as its name indicates, quarried in the Forest of Dean, Gloucestershire, the beds suited to our purpose lying deep. When the upper and inferior

rock has been removed by blasting or otherwise, the valuable blue stone is detached in masses by wedging, a vertical cleavage being ensured. Among the powerful machinery at one of the principal quarries is a remarkable circular-toothed saw for cutting through big blocks; but though this cuts quickly, it is accompanied with waste of material, and makes slovenly work, and the ordinary sawing is with the toothless saw and sand. Blocks and slabs of Forest stone are to be had, practically, to any size. It weighs 12 cub: ft. to the ton. It is not quite so hard as Sicilian marble, but, owing to its grity nature, it rapidly frets away the tools used on it, which need to be highly tempered and thin. It is, however, an admirable carving stone; there are no inequalities in its grain, and it permits of high finish. The work looks—to use a technical phrase—full of life. Owing to its peculiarly cool and pleasing colour, the quality of the shadows cast in it is delightful. And it has this special advantage, that if the lettering is well and deeply cut it will be perfectly legible if left in a natural state; in fact, in really fine work the lettering ought to be so left. Before lettering, the sawn tace has to be rubbed down with coarse sand and then with a grit. Bilston stone is good for the latter purpose. So also is Hollington, which cuts more rapidly. Compared with most stones, Forest mosses or discolours very little. It stands exposure to the weather admirably; in fact, where the price will permit it to be used, no better stone



Propagator for Plants.

for outdoor work could be desired. Whilst as regards taste it is scarcely possible to imagine any surroundings, new or old with which it would not harmonise.

sapwood of Timber.—Beneath the bark of all trees there is found a circle of wood not so fully matured as that nearer the heart. This is known as sapwood. In some timbers, such as bickory and elm, this sapwood may be easily distinguished by the difference in colour. In others, such as pine and deal, the variation in colour is not so noticeable unless the sapwood is stained with water, when it assumes a greenish hue. In ash trees the difference between the sapwood and the heart cannot usually be distinguished, but in old trees the heart becomes brown, and sometimes nearly black. Oak trees contain a large amount of sapwood; sometimes as much as 2½ in., or even more, may be found. This is lighter in colour than the inner portion of the tree, and will often ret away before the heartwood is thoroughly seasoned. The amount of sapwood present in a log is due partly to the nature of the soil and partly to the season of felling. Trees cut down in late spring, when the sap is rising, or in early autumn, when the sap is falling, show a large percentage of sapwood in the timber. Speaking generally, the sapwood of ash is tougher than the heartwood, yet not quite so hard. The sapwood of hickory and elm is as strong as the heartwood, but is more liable to the attacks of insect pests. When wormeaten pieces of these timbers are examined, it is often found that most of the worms have penetrated to the heartwood, and have there stopped. The sapwood of oak, pine, walnut, and deal is weak, is liable to become worm-eaten and to rot away, and should always be cut off by the sawyer in converting the timber.

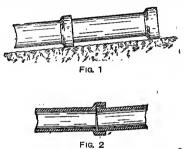
Polishing Mediums for Giass.—There are many polishing mediums for glass, and a favourite one is rouge and pitch. But the cleanest and one of the quickest is paper and tripoli powder, and this can be recommended.

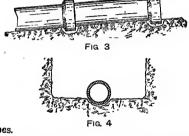
Remedy for Rough French-polishing.—Often, despite the utmost care, French-polished work comes up rough, stringy, or linty, more especially in repolishing; this is due in great measure to the action of the new polish on the old. No matter how much the pounce bag (pumtee powder) may be used, it seems impossible to get a bite, and in such a case Bath brick may be recommended. To use it, take a piece of flew worn glasspaper in the left hand and a piece of Bath brick in the right, hold them over the job, and lightly rub the two faces together, thus allowing the fine dust to be scattered over the work; owing to its great cutting power, Bath brick should be used with caution. Do not charge the rubber with polish at this stage; simply work out the polish already present by adding spirits and using oil a little more freely. When all is out to a level surface and the old and the new polish blend together, then add polish. Should, however, new work persist in coming up rough, the fault may arise from working the rubber to dry; then there is not sufficient polish in the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the rubber to enable it to clear out, and in such a case the ru

Laying Drain Pipes.—The laying of the pipes commences at the junction with the sewer, and the spigot end nearest the junction. The trench should be excavated to the required depth, and the hottom rounded to the curve of the pipe (see Fig. 4); this having been done, a further excavation should be made just below where the socket of the pipe is to come (see Fig. 3), so that the pipe will be supported along its whole length. If this is not done, the pipe becomes virtually a beam loaded the whole length and supported at each end

blue with water and add to the whiting. Melt the size without letting it boil, adding enough water to prevent burning, and pour on the whiting, mixing well. Strain through paperhanger's canvas, doubled, to thoroughly mix and to remove impurities, after which it may be allowed to stand all night in a cool place; when cold it will be a jelly. The proportions of size to whiting are about 1 lb. of double size to 1 ball of whiting. Naples yellow, the siennas, the umbers, vandyke hrown, ivory black, Indian red, light red, vermilion, madder lake, French ultramarine, and ochre are suitable colours to be used in distemper. Plaster is painted hefore distempering, so that an old coat of distemper may be easily removed before a new one is applied. A celling is lined before distempering in order to hold the plaster together, to secure equal suction, to cover stains, and to prevent any free lime or any hostile material from affecting the distemper. In cases where a ceiting has been patched, rubbing a little of the old washed-off distemper over the patch will keep it from drying whiter than the rest of the ceiling.

Dental Cements.—These are of two kinds, namely, zinc chloride and phosphate zinc, the former being the older. They are powders which, when mixed with certain liquids, produce a stone-like mass. Zinc chloride cement is a powder consisting of zinc chloride and glass, and the liquid used is a solution of the former. A typical cement is Fairthorne's, made by finely powdering and mixing 5 parts of glass, 4 parts of borax, 8 parts of silicic acid (SiO₂), and 200 parts of zinc chloride, and tinting with a small quantity of ochre or manganese. For use, this compound is mixed with concentrated, syrupy solution of zinc chloride, and soon becomes as hard as marble. As an example of a phosphate cement, Rostaing's rather intricate formula is here given: Melt





Laying Drain Pipes.

(Fig. 1), either breaking down with the load of earth, or, if it does not break down, the jointing material at the bottom is crushed, thus allowing sewage to escape; and the joint opens at the top, giving exit to sewer gases, as shown in Fig. 2. The foundation should be solid; if found to be soft, it should be made hard by ramming, by laying timber, by brickwork or concrete, or in some other manner. This work should not be scamped, or it will eventually have to be re-done, and quite possibly within a very short time.

Cleaning Sewing Machines.—The domestic sewing machine, which is sometimes allowed to stand idle for weeks and even for months, often hecomes corroded and stiff, and before it can be used has to be cleaned. Sometimes paraffin freely used on all parts and them wiped over with a duster will sufficiently clean the machine so that it can be worked easily. If this does not suffice, strip the machine of all fittings, place all bright parts (not japanned) in water, adding a good quantity of soda, bell them until quite clean, and wipe briskly with a clean wiper, afterwards polishing them carefully with mery cloth, being sure to wipe off all emery oust before replacing the parts in the machine. The shaft bearings, etc., may be scraped with a scraper, or carefully cleaned out with emery cloth, but if emery is used be sure to wash out the hearings with paraffin.

Clearcoling and Distempering.—Clearcole is a thin liquid, and is used to stop suction before applying distemper; distemper is a full-bodled smooth semi-liquid, one coat alone of which is capable of covering a surface; a second coat of distemper when laid over the first never looks well. To make clearcole, dissolve ½ lh. of double size and a piece of alumn the size of a walnut in 2 qt. of hot water with whiting. This may be applied warm. To make distemper, put the whiting in a pail and cover with water, lefting it stand till thoroughly slaked; then pour the water off and work up well with the hare hand. Mix about half an eggcupin of dry ultramarine

in a crucible an intimate mixture of 1 part of secondary calcium phosphate (CaHPO4) with 15 parts of pure zinc oxide and 164 parts of secondary ammonium phosphate ((NH₄)HPO₄) until the mixture flows quietly and uniformly. When cool, powder the mass and dissolve it in dilute phosphoric acid, and then cadmium oxide to the extent of 5 per cent. of the molten mass. When all is dissolved completely, evaporate to the consistency of syrup. As a separate operation, make up a mixture of 2,500 parts of zinc oxide and 500 parts of magnesia, with sufficient horacic acid dissolved in water to form a stiff paste; dry this and calcine in a Hessian crucible for some hours at a white heat. Finely pulverise the greenish mass obtained, and roast it in the air until it turns white, and then tint as desired with manganess peroxide or ochre. When required for use, make this into a paste with the solution obtained as described above.

To Obtain the f Value of a Lens.—For this purpose the camera is focussed on a distant object, and the distance from the centre of the lens to the ground-glass screen is measured exactly. Then the diameter of any stop divided into this distance gives the f value. Thus, if a lens works with a stop 1 in. in diameter, and the distance hetween the lens and the ground glass is 1 ft. 4 in., the value will he f/16; and this aperture with this focal length will work exactly as quickly as an aperture of $\frac{1}{2}$ in. with a focal length of 8 in. f/16 is not half the speed of f/8, but one-fourth; and f/32 is one-fourth the speed of f/16, and one-sixteenth the speed of f/16.

Imitating Wood Carvings. — For imitating wood carvings in plaster, bronze, and other materials, a German process is to cover thickly the model, made from porous oak, with a 2 per cent, solution of colledion; when this coating dries, it leaves unaltered the usual dull and porous appearance of the wood, but the model or pattern is quite oil-proof, and the casting can be proceeded with in the usual way.

Wrought-iron Signs.—The wrought-iron sign here illustrated (see Fig. 1) is shown as an example of a realiy elaborate specimen of wrought hammered ironwork. A sign of this kind is fastened by screws and rivets to a strong back-plate (Fig. 2), which is made of wrought flat iron bar, 2 in. wide by \(\frac{2}{3} \) in. thick, with the wider portions of the straight back-plate bar and the ornamental pieces in the centre and at the ends bolted on. This plate, when the bracket of the sign has been affixed, should be fastened to the back wall of the house with bolts and nuts. The main scroll construction of the bracket to hold the sign proper may be of wrought welded tubing, \(\frac{2}{3} \) in. in diameter inside and say 1 in. outside. This should be welded together at the junction of the straight rod carrying the sign with the large scroll, also in the centre of the straight rod, and at the bottom side of the large scroll. At the top portion is a

letters will show through with great effect. This sign may be fixed to the bracket support or allowed to hang on a ring. Figs. 4 and 5 show elevation and section of an alternative design for the sign proper. This is constructed of two oval rings made of iron bars, 1 in. by $\frac{1}{2}$ in., held together by wrought-iron balls riveted at intervals, and ornamented with scrolls of iron bars, $\frac{3}{2}$ in. wide by $\frac{1}{16}$ in thick. The letters forming the name and trade are made of iron, $\frac{1}{2}$ in. wide by $\frac{1}{16}$ in thick, riveted to the scroll bars, which are fastened to the inside of the oval framework. The painting of the work when complete may be to the taste of the maker. The sign may be constructed at a less cost by reducing the amount of ornamental work on the main scroll, the design allowing for this. Thus, in the lower portion of the scroll bracket, the spray of leaves in one place and the spray of balls just above may be removed without affecting the stability of the work.



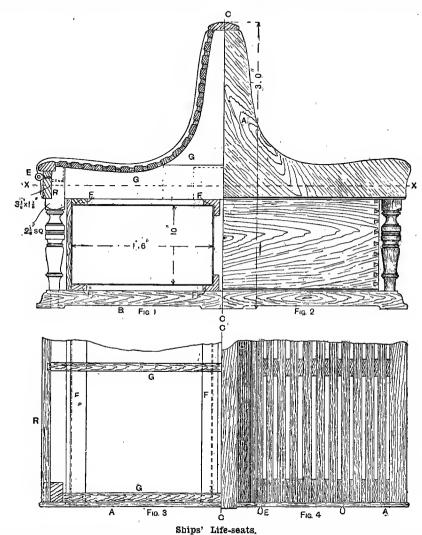
Wrought-iron Signs.

bracket made of iron bar, 1 in. wide by § in. or \$\frac{3}\$ in. thick, tapered at the upper scroll to \$\frac{3}\$ in. wide and affixed to the top bracket with screws which are covered by an ornamental boss. The leaves are made of charcoal iron No. 14 or No. 16 B.W.G., hammered to shape, ornamented, and welded on the scroll bar. The leaves ornamenting the scroll are all made in the same way, but double—that is, two sides fitting together round the scroll bar; they may be fastened with screws or rivets. The ornamenting scrolls may be made of iron bar, \$\frac{1}{3}\$ in., with the leaves and scrolls welded together. The centre rose of the large scroll is made of three plates of No. 14 or No. 16 B.W.G. charcoal iron cut out to pattern, hammered to shape, and fixed on each side of the centre of the large scroll with a double ornamented screw boss. The ornamental scrolls and leaves in the centre of the straight arm and at the end of the same are made of iron, say \$\frac{1}{2}\$ in. or \$\frac{1}{2}\$ in. by \$\frac{1}{2}\$ in. thick, and welded together. This completes the bracket portion of the aign. For the sign proper two methods of construction are given. For Figs. 1 and 3 the sign may be made of sheet iron (charcoal preferred), from which the letters should be cut out and the plate riveted between a frame of iron, 1\frac{1}{2}\$ in. by \$\frac{1}{2}\$ in., having scroll ornaments of light wrought work. This plate may be enamelled or painted any colour, and the perforated

Brunswick black thinned out being sometimes used for this purpose. These stains are used either as spirit or as water stains, or they are applied to varnish. If laid directly upon the wood they are liable to present an uneven appearance; to prevent this, the wood is sometimes sized, or a filter, composed of starch or whiting, or some absorbent material, may be used. As an example, a good oak-coloured filter may be made of finely crushed whiting levigated and dried and coloured with yellow ochre and sienna, mixed to a paste with japanner's gold-size and a little turpentine, and rubbed into the grain with a rag. If no filling is used, the knots may be treated with size and whiting if for water staining; ordinary putty may be used for spirit stain. In all staining, care must be taken not to raise the grain of the wood; glasspaper should be used cantiously and rubbed the way of the grain; if it is rubbed across the grain, every mark will show. Nails must be punched down, and the holes filled with whiting putty for water stain, and with oil putty for spirit atain. The stain may be applied fully with brushes, and badgered to make it even, or wiped off the surface with rag. Stains are bright and effective, but are liable to injury; the wood contracts, and in time white lines appear round panels, etc. Stained work does not wear so well as painted work.

Preparing Glue for Use.—The cakes of glue should be broken into small pieces by wrapping them in canvas and striking with a hammer. If the canvas is not used, the glue will fly into small fragments, many of which will be lost. Put the glue into a clean vessel and cover with cold water, allowing it to remain until the next day, when it will have absorbed some of the water and will present the appearance of pieces of jelly. Place this into the inner vessel of a glue-pot and just cover with water, then keep the water bolling in the outer vessel for two or three hours. To test for thick-

of the seat, and have holes bored at each end to correspond with the pins at the bottom ends of the legs. The bearers are also shaped out on the under side as shown. The front rails are screwed to the legs, and the holes dowelled up. After the grounds, legs, front rails, and bearers have been put together, the frames can be turned upside down and the fillets r (Figs. 1 and 3) for receiving the tanks can be screwed on. The frame would then be turned on its feet again, the sparring fixed in place, and the beads for covering up the grounds bradded on. The ends would then be flushed, and the



ness, dip the brush into the glue, and if it just runs easily without breaking into drops it is fit for use. Some workmen test the thickness by rubbing between the finger and thumb, but this test requires experience. The inner pot should never be placed on the fire direct, or the glue will burn and become worthless.

Ships' Life-seats.—A ship's life-seat is a sparred deck-seat with the addition of watertight tanks; usually made of copper, and a life-line, drawn through lashing eyes, and carried all round the seat. The seats should not exceed 8 ft. in length, as beyond that they are unwieldy. The seat shown in Figs. 1 and 2 is made up of grounds (Figs. 1 and 3), the end ones being mortised and tenoned into the end legs, and the intermediate brackets or grounds being raggle-dovetailed to the front rails R. The legs are turned with a round pin at the bottom, and are rebated on the face side to receive the front rail. Bearers B (Fig. 1) are carried across the whole width

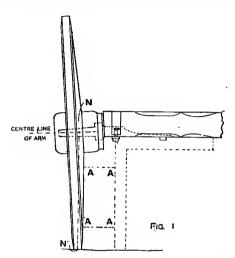
facing A (Figs. 2, 3, and 4) fixed on. This facing has a bead on the under edge. A box is made for covering the tanks, and the length of the longest piece is the length of the seat outside the ½-in. facings at each end. The length of the end pieces is the size over the outside fillets, plus the thickness of the two long pieces. A bead is run on the bottom edge of the end pieces, and the pins are divided so as to allow the bead to run through to the front. The pins are put on the sides, so that the ends can be taken off to ship the tanks, as shown in Fig. 1. The top cope c (Figs. 1 and 3) is fixed to the top ends of the grounds and allowed to project a little over the end facings and rounded off. The lashing eyes E (Figs. 1 and 4) for carrying the life-lines are fixed at about 14-in. centres. A ring and plate is screwed to the facings about one-third of the height from the top, and another is fixed to the deck, and a thin lashing carried from one to the other. Finally, Fig. 3 is a part section on the line x x (Figs. 1 and 2).

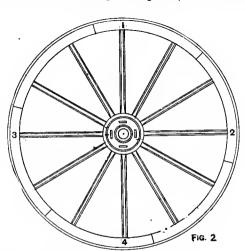
Artificial Indigo.—For making indigo by chemical means, an expensive process, a solution of a-isatine-anilide may be reduced with ammonium sulphide. In the process, 40 kg. of a freshly prepared ammonium sulphide solution, containing 10 per cent. of hydrogen sulphide, is made to flow quickly, and with constant stirring, into a heated solution of 20 kg. of isatine-anilide in 60 kg. of alcohol. There is spontaneous heating, temporary green and blue coloration, and an immediate separation of indigo in the form of small crystalline needles of a faint copper-like lustre. The heating is continued, presumably by external means, to bolling point, when the indigo is obtained by filtration, re-washed with alcohol, and dried.

Boxing Wheels for Vehicles.—If the wheels of a vehicle are not correctly boxed, the draught is increased, which means harder work for the horse and extra wear and tear on the underworks. In setting out the hub of a wheel to be boxed, it must be accurately oentred with the compasses both at back and front, otherwise the line of alteration in the wedging will be greatly increased, and the hub itself will run eccentric, and, of course, the rim with it. A wheel boxed in this way can be made to run true on the face line of the rim at the tyre, but there is a rise and fall in the vertical line of the wheel in every revolution, which both increases the draught and tends to knock the wheel to

shoulder of the axle, which tends to force the weight against the coilar, and so steady it in the running. In the boxing, a wheel can only be trued at the extremes of its two diameters, 1, 2, 3, 4 (Fig. 2), and wedged from these directions. A wheel tyred and boxed correctly will touch these four points in their revolution, but should the tyre have been hollow edgeways and not straightened before bending, the wheel will never be got true in boxing, and will only touch at two points correctly. A wheel that has been properly boxed requires no more than four wedges. The front of the box ought not to be wedged at all, but should fit the hub firmly. The wheel having been trined vertically with a plumb spoke, the square should be applied to the axle casing borizontally, so as to bring the horizontal diameter true to the arm at points 1 and 2. Should an arm not have the correct drop, it may be heated at the neck and altered with the hammer by the smith, but it is a bad plan to resort to this if letting the flap into the casing to alter its line is possible. However, it is not very often done in heavy wheelwright's work, and cannot always be avoided.

Defects of Timber.—The strength of timber is affected by numerons causes, such as the nature of the soil; position; manner of felling; method of handling after felling; method of seasoning, over-drying having the effect of destroying its toughness; method of con-





Boxing Wheels for Vehicles.

pieces. When a wheel is to be boxed, first plug the centre hole in the stock, making the surface on the back of the hub perfectly level; then, with the compasses, take the tight size of the back of the box, and mark it off on the hub from the centre. Before commencing to cut, with the rule measure the distance from the box to the outside of the hub at the two diameters, because a shaving in the lean of the box to one side makes much difference in the trueing of the wheel at the rim. The box should be centred at the front of the hub to the size of the nose in the same way as the centre of the back of the box, so that a true line in the centre of the bub may be got. In most modern shops a boxing machine is used for cutting the back and front sizes of the box. This tool adjusts itself to size, so that if the machine has been properly fixed to the hub of the wheel, and the box snngly forced in, no wedges are necessary. When a wheel is boxed by hand, a triangular tool called a buzz, a stout three-quarter chisel, and a large gouge are used. The shoulder of the box should rest against the shoulder cut out for it in the hub, but from the shoulder to within 2 in. of the nose of the box the hub should be cut clear of the surface of the box, particularly in the line of the spoke ends; then, in retyring the wheels, the spoke ends do not touch the surface of the box, and thus will not fracture it by the pounding of the spoke ends. Fig. I shows how a wheel ought to stand when the axle has been let into the casing to suit the fall of the arm. This is pitched from the collar by the axle-maker to the dish of the wheel, so as to bring the under spoke plumb and at right angles to the axle casing, as shown by the square line N N and the parallel lines A A. The centre of a box should pass vertically through the centre of the tyre as at N N. It is hetter when this line is a little towards the

verting by the sawyer, who has to exercise considerable care and skill in cutting the logs to the best advantage to remove defects; the attacks of worms and other insects, whose injuries to the wood, though small when taken singly, will collectively prove a serious matter. There is a great variation in the strength of the same kinds of timber. A pleoe of oak may be found as soft as deal, or a piece of ash as light and brittle as pine; and it requires a great amount of practical skill to distinguish between the good qualities and the bad. Even the most skilful judges are sometimes deceived, especially with log timber. Often a tree apparently sound will, when cut up, be found to have defects rendering most of its timber of little value.

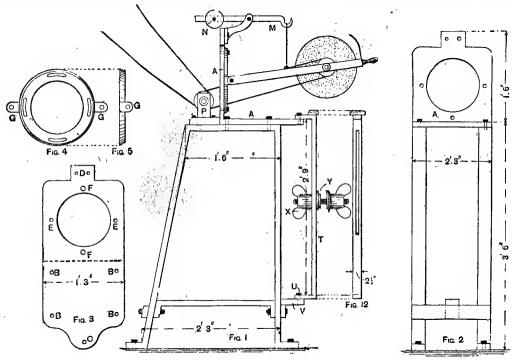
Lime for Plasterers' Work.—Chalk lime, otherwise known as rich, fat, or pure lime, is used for plastering for the following reasons: It slakes, easily and tho roughly. It is economical, the slaking process causing it to swell to two or three times its original bulk. It works easily. It is deficient in strength but strength is not required. It is porous, and therefore temporarily absorbs the moisture which condenses on a wall upon a sudden rise of temperature. It is cheap in the first instance. It does not spoil, but rather improves, by being mixed a considerable time before it is required for use; this is called cooling it. Lias lime, otherwise known as blue lias, and grey chalk lime, otherwise known as stone lime, ground lime, grey lime, etc., are grey lime slakes freely, but is not so economical as chalk lime, and forms a less absorbent surface. Lias lime slakes very sluggishly, is very liable to blow when used on walls for plastering, and gives a non-absorbent surface.

Locating "Knock" in Steam Engine.—If the trouble does not yield to an adjustment of the valves, which should furnish sufficient cushion to take up the momentum of the moving parts, there is something out of line or adjustment. See that there is not an excessive loss of motion in the bearings, and boxes, and after that proceed to examine the engine carefully. If the pound is outside the cylinder, look for evidence of heating. Unpin the connecting rod from the crank-pin, and see whether it swings fairly by the pin when it is tight in the cross-head; see that the crank-pin is square with the web, and the web square with the shaft. See that the cross-head is true, that the rod is in line with the guides, and central in the stuffing-hox at all points of the stroke. See also that the piston is central and tight on the rod, and that the rod is tight in the cross-head.

Australian Soft Woods.—The numerous soft woods of Australia are admirably adapted for the manufacture of furniture and for other industrial purposes. The more useful of the soft and fancy woods include the beech, which attains a height of 100 ft. to 150 ft., with a diameter of 3 ft. to 5 ft., giving a strong, white, closegrained, and durable wood, easily worked, and greatly

der, and then automatically raising it again to its former position. The cylindrical frame revolves on trunnions, so that it can be swung to a horizontal position, which is the most convenient method for inserting or removing tracings and paper from the frame. In operating, the cylinder is revolved to a horizontal position, and the tracings and sensitised paper are placed around the outside of the cylinder, being confined by stout canvas covers, which are drawn tight by turning a lever; thus ensuring perfect contact hetween tracings, sensitised paper, and the glass. The cylinder is then swung to the opposite horizontal position, and the same manipulation repeated, after which it is returned and looked in a vertical position, and is ready for printing. By simply touching a lever the arc lamp starts in its descent through the centre of the cylinder at a speed which can be regulated to suit the sensitiveness of the paper employed. When the lamp has reached the lowest point of printing surface it automatically reverses its motion, and quickly returns to its original position above the cylinder.

Saw-gulleting Machine.—A machine for gulleting circular saws is shown in side elevation by Fig. 1.



Saw-gulleting Machins.

valued for decks of vessels, flooring, turnery, and furniture making; the black bean, growing to a height of 120 ft. to 130 ft., with a diameter of from 4 ft. to 5 ft., with a handsome, close-grained, dark-coloured, durable wood; the black oak used for bullock yokes, tool handles, shingles, etc.; and the black wood, resembling walnut, and highly valued for making furniture. Another valuable timber is the rosewood, strong-grained and durable, with a colour resembling Spanish mahogany. The silky oak attains a height of 70 ft. to 80 ft., and its wood is of a light grey colour, beautifully crossed with silvery waves, and when polished the surface has a delicate lustre. Bedroom suites made from this wood possess a dainty appearance. Satinwood is another useful timber, yellow in colour, soft and silky to the touch, olose-grained, and easily wrought; this wood is also suitable for cabinet-making, and is considered to be superior to satinwood.

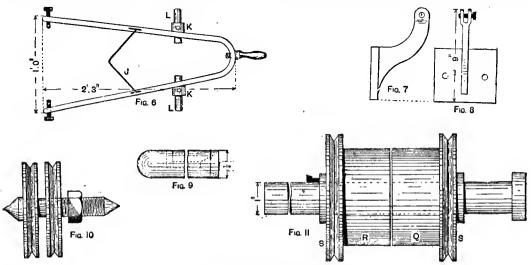
Automatic Blue-printing Machine.—In one form this consists of a cylindrical printing-frame, composed of two heavy curved plates of glass; there is also an adjustable, though rigid, frame, together with two tubular uprights which support an arc lamp and the automatic drive-mechanism. This drive operates the lamp, having means for lowering it through the cylin-

Such a machine is very useful in a small sawmill, and may be driven from below or, as represented, from overhead. It may be constructed almost wholly of wroughtiron, and the main standard, or frame, may be 2½ in. by ½ in, in section. Two lengths of iron are bent, and stiffened with stays secured by bolts. On the top of this frame a plate A (Figs. I and 2) of ½ in. iron is secured by four bolts screwed into tapped holes B (Fig. 3). This plate, with the stays, makes a rigid frame. The plate is bent at right angles on the dotted line shown in Fig. 3. The hole C may be tapped, and the two holes D are tapped for small bolts that connect a bracket with a forked arm (Figs. 7 and 8); this carries a balanced arm for suspending the swing carriage of the emery wheel. The studs B are passed through slots in the circular piece (Figs. 4 and 5), which may be made from ½-in, iron, the bolts F (Fig. 3) holding it in position. The lugs 6 (Fig. 5) have holes for bolts that connect to the swing carriage. The four slets allow the carriage to be set at any angle required for giving lead to the saw teeth. Fig. 6 is a plan of the swing carriage, which may be either cast or forged from wrought-iron. Brasses K support the centres L, in which the spindle runs that carries the emery wheel. Into a tapped hole is screwed a handle, by which the carriage is lowered and raised when guileting the saw teeth. The balanced arm M

(Fig. 1) is pivoted on a bolt in the fork (Figs. 7 and 8), and the wire J (Fig. 6), which passes over the crook in the arm, suspends the carriage. N (Fig. 1) is the weight that balances the carriage. Fig. 9 illustrates a centre, the dotted lines showing the oil-way and the concavity that receives the end of the spindle (Fig. 10). On the last are two narrow, grooved pulleys for the band that drives the wheel. The enery wheel is placed between them, and is secured by the nut. The pulley faces must be perfectly true, and washers of stout paper or soft leather should be placed between them and the wheel. The centres and spindle must be of hardened steel, turned true in a lathe. The driving shaft (Fig. 11) is 1 ft. 3 in. long, and runs in two small bearings P (Fig. 1). The fast pulley Q (Fig. 11) and the loose pulley R receive the driving beit, and from the grooved flanges s the rope or gut band leads to the pulley on the side of the emery wheel. The appliance T (Fig. 1) for carrying the saw is fixed by a boit C (Fig. 3), and by another U (Fig. 1) in the bracket V. Fig. 12 shows a front view of this appliance. A piece of wood is secured by two screws to the top of T, and answers as a hearing-piece for the saw-plate while the teeth are being guilleted. The pin

goes to the spinning and doubling departments, where it is twisted. The thread then passes on to the weaving and braiding department, and is made into cloth, tape, and yarn for packings. The cloth is then proofed with rubber, forming what is called asbestos and rubber woven sheeting, tape, and rings for jointing purposes, also rolled cloth and square block packings for glands. These cloths and packings are also made metallite by combining woven wire therewith, which proves very effectual for hydraulic work, and is largely used by marine engineers. Asbestos-metallic cloth is the material usually employed for making fireproof curtains for use in theatres on account of its great heat-resisting properties.

Constituents of Lime Mortar.—In the ordinary constituents of lime mortar, the lime in contact with the sand performs the same duties as mortar in connection with brickwork; that is, the lime does not chemically alter the grains of sand, but binds them together as one solid body, which ultimately approaches the character of a siliceous limestone. To bring about a perfect combination of the ingredients, it is necessary that the sand



Saw-gulleting Machine.

on which the winged nut x is screwed is passed through the slot in T, and then acrewed up tightly at any point, thus allowing saws at different diameters to be guileted. The other nut fastens a washer against the saw after the eye of the saw has been placed over the shoulder y.

"Silver Metal" Hard Alloy.—Spacing levers of typewriters are used incessantly, and if made of iron or steel and nickel-plated, even heavily, the plating soon wears off, leaving the metal exposed to rust and corrosion; brass is even more objectionable than iron or steel. The metal generally used is "aluminium silver," or "silver metal," the proportions of which are: Copper 57 per cent., nickel 20 per cent., zinc 20 per cent., and aluminium 3 per cent. Spacing levers made of this alloy are nickel-plated for the sake of the first appearance, but as far as corrosion is concerned this is unnecessary. The alloy is strong, and cannot be bent to any extent without breaking, especially if the percentage of aluminium is increased to 3.5 per cent.; it casts free from pinholes and blowholes; the liquid metal completely fills the mould, giving sharp, clean castings, true to pattern. Its cost is not greater than the cost of brass, its colour is silver white, and its hardness makes it susceptible of a high polish.

Manufacture of Asbestos Goods.—The crude blocks of asbestos fibre, as mined, are crushed and opened by special machines, which do not destroy the fibre, and are then placed in shaking machines, where the long fibre becomes separated from the short, and all particles of rocky substances are removed. The long fibre is passed to carding and condensing departments, the short fibre being used up in milliboard and boiler coverings. The long fibre comes from the condensers in the form of condensed thread without any twist, and it folds itself in cans placed to receive it, and thence it

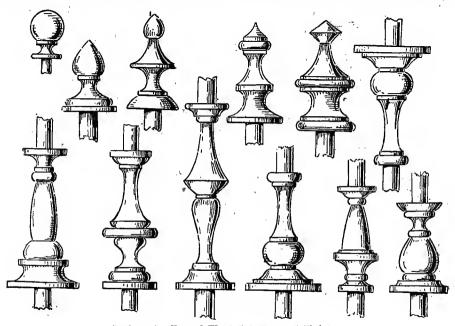
should be free from impurities and the lime fresh. If impurities be present, the adhesive qualities of the lime are weakened and its setting properties destroyed. The relative proportions of lime and sand depend on the class of limestone used. Lime by itself is useless for mortar; it would crack and remain soft for an indefinite period; but when sand is mixed with it in proper proportions, it becomes a good cementing material. The proportion of sand to lime is governed by the impurities—useful or otherwise—present in the limestone. For instance, a pure, rich, or fat lime contains about 98 per cent, of calcium carbonate, and will bear 3 to 3½ of sand to 1 of lime; white an eminently hydraulic lime contains 36 per cent, of cuseful impurities, and will only bear sand in proportion of 2 or less to 1 of lime. It should be remembered that the tensile strength of sand is greater than that of lime, therefore only sufficient lime need be present to unite the grains of sand together and the bricks to each other.

By-products of Mineral Oils.—The primary aim in the treatment of crude petroleum is the production of kerosene, but crude oil contains oils or spirits, such as naphtha and gasoline, lighter than kerosene, and others, such as paraffin, that are much heavier. At one time all these except kerosene were waste. At low temperatures of distillation the lighter oils, such as naphtha, benzine, gasoline, and petrol, are freed and collected; at higher temperatures come the kerosenes of varying flash points and densities, the remainder being worked into hard paraffin and soft paraffin or vaseline. Even these leave a heavy oil, which is used as lubricating and fuel oil, much of it being made into car and axle grease. After all these processes a solid mass of carbon is left in the retorts, and much of this is used for making carbon pencils for electric are lamps.

Cleaning Mounted Horns.—For cleaning some mounted ox horns that have become yellow and dirty with age, if the horns are mounted together with the pate, first remove the skin, which will probably be tacked on behind, and place it in benzoline until thoroughly saturated. Then well wash the horns with hot water and soap and soda, using a scrubbing brush. If etill discoloured on drying, the horns may be repolished as follows: Having removed the auriace polish already existing, also the discoloration, with sandpaper of various grades, from coarse to fine, well rub the horns all over with pumice powder made into a paste with lard oil. Then apply putty powder in the same way and proceed to bring up the polish with a series of cloths, commencing with a coarse one and finishing with a soft one, and lastly the hand. Then dry the hair by well rubbing it with fine sawdust, which can afterwards he shaken, beaten, and then blown out with the bellows.

Designs for Turned Wood Spindles and Finials.— The accompanying illustrations are of spindles and finials suitable for small cabinet work, for supporting shelves, etc. They can be very easily turned in a small foot-lathe by an amateur. The wood to be employed times inclining to a light brown. When well burnt it weighs usually from 110 lb. to 120 lb. per imperial striked busbel. The heavy cement is used for foundations, retaining walls, and engineering work generally; the light cement for concrete floors, rendering walls, etc. A concrete floor may fall from the supports being taken away before the cement has properly set, or from a hard frost occurring while the concrete is fresh, or from the cement not being in sufficient quantity.

Oils and Fats.—The word oil was originally applied to all those fluids that are viscous, or which flow but slowly, as well as to the fluids obtained from animal and vegetable sources by expression or distillation; the term, therefore, embraced not only animal and vegetable oils, but oils of turpentine and essences, also very dissimilar products such as sulphuric acid, the old name for which was oil of vitriol. Owing to the development of chemical knowledge and the better classification of different products, the term oil is now used only for two classes of products; the class obtained chiefly by expression are termed fixed oils, because on heating they do not distil without decomposition; the other, obtained chiefly by distillation, are termed volatile oils, being



Designs for Turned Wood Spindles and Finials.

depends, of course, on the material used for the rest of the article, but a pattern should be selected which will not easily break if it has any force to withstand. Also keep the edges of the mouldings well defined, or the pattern will be lost and the lines will not look firm. The spindles, etc., may also be turned in brass if required, and will be very suitable for making up small stands for kettles, etc.

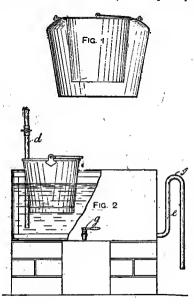
Roman and Portland Cements.—Roman cement, originally called Parker's cement, is a natural cement obtained by calcining the nodular masses of clayey limestone called septaria, containing 30 to 40 per cent. of clay, found embedded in the London clay, and also in the Carboniferous and Liassic shales. It is of a rich brown colour, weighing 701h. to 75 lb. per bushel, setting within fifteen minutes of being gauged into paste. It is of little strength, and will not bear more than an equal part of sand in forming mortar. It is used for repairing dock walls and tide work generally, for setting coppers, and for internal rendering on a damp wall. Portland cement, so called from its resemblance to various ingredients intimately mixed, calcined, and ground, finally consisting of 35 per cent. clay, 65 per cent. lime, 5 per cent. iron, etc. Materials used are chalk and clay by the wet process, limestone and clay or shale by the dry process. The wet process is usually employed on the Thames and Medway. The colour of the manufactured cement is a bluish grey, but some-

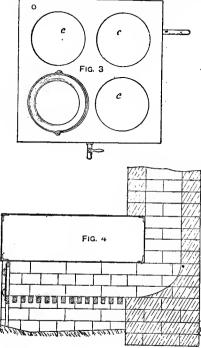
capable of distilling unchanged by a very slight heat. Fixed oils are usually ranked with the fats, which they closely resemble in all their properties; it is only at an ordinary temperature that any difference is perceptible, when the former are fluid and the latter solid; at a temperature of 150° F. they are all oily bodies. Oils and fats are all "greasy" bodies; that is to say, when placed between two surfaces they adhere to both and yet cause the surfaces to slip readily away from each other, hence their value for lubricating purposes. Another property which they possess is their incompatibility with water; when oil and water come together they do not mix; when water runs over a fatty substance it does not wet the surface. This property is extremely useful to the painter, who uses oil in paints and varnishes as a protective material. Surfaces coated with these materials are, by reason of this incompatibility, protected from the destructive action of water. Oils are fluid and more or less viscous substances, varying considerably in colour according to the care taken in their extraction or subsequent purification. Some, such as castor oil, are colourless; some, such as olive oil, yellow or green; palm oil is orange; fish oils are brown; impure oils are black. The value of an oil depends largely upon its colour—the paler it is, the higher price it will command. Oils have often a characteristic odour and faste; for instance, linseed oil, castor oil, and fish oils are by these simple tests readily detected. Oils are lighter than water, their density varying between '913 and '970 (water as 1).

Testing Slates for Quality.—Good slates are hard and tough to resist breaking, and give a good ring when struck with the knuckies. They bave flat but somewhat rough surfaces, close fine grain, and firm edges. They do not fracture when holded or squared. They are uniform in size, colour, and thickness, without light coloured veins, and free from patches of "marcasite," or white iron pyrites, which cause decay on exposure. They are non-absorbent; the most absorbent generally feel smooth and greasy. To judge of the quality, stand a slate up to half its depth in water for twelve hours, when no sign of moisture should appear more than ½ in. above the water-line. The slate having been thoroughly dried and then immersed in water for twelve hours, the difference of weight before and after immersion should not exceed 1 per cent. A good slate, when breathed upon, should not emit a strong clayey odour; if it does, it will probably not weather well.

Glue-pots and Tanks.—Different kinds of glue-pots are used, according to the quantity required. For home use, the glue may be melted in a cup or tin placed in a saucepan of boiling water. In this case, as only a little will be required, the soaking in cold water may be dispensed with, the pieces of glue being simply put into the cup, covered with water, and Irequently stirred

locally as additional ingredients, or replacing one or other of the normal constituents and more or less altering the structure and appearance of the rock mass. Granite is very variable in its hue and texture. When the rock is fine-grained, but contains large orystals of felspar, it is known as porphyritic granite, as in the fiesh-coloured or reddish variety from Shap and the grey variety of Dartmoor. The fine-grained varieties are sometimes termed granulites. The prevailing hues are sometimes termed granulites. The prevailing hues are grey, and flesh-coloured or red. The grey colour is due to disseminated specks of black mica in a ground of white fclspar and quartz, and the red colour is entirely due to the felspar. Granite is usually an exceedingly durable stone; it absorbs but little water, and is therefore little liable to wear away on exposure. Its crushing strength is also very high, some specimens requiring a force of 4 tons to 6 tons per square inch to crush them. For these reasons granite is one of the





Glue pots and Tanks.

until dissolved. For workshop use the ordinary gluepot (Fig. 1) may be used. In large workshops, where a quantity of glue is used, and steam-pipes are laid on for heating purposes, a tank constructed as shown in Figs. 2 and 5 may be used. It is made of 1-in. plate iron or steel, with four holes (c, Fig. 3) in the top, large enough to accommodate buckets or specially made gluepois; d indicates a steam-pipe carried nearly to the bottom of the tank, e an overflow pipe to carry away the waste water produced by the condensation of the steam. A small hole must be provided in this at f, or at will syphom all the water out of the tank. A tap is provided at g for cleaning out, or if the tank is used to furnish a supply of hot water. When required for use, the tank is filled with water and the steam turned into it, which will cause the water to boil. If steam pipes are not laid on, the glue-tank may be constructed as shown in Fig. 4, and heated with coal or waste wool.

Characteristics and Uses of Granite.—Granite is a crystalline rock occurring usually as the fundamental rock in many of our mountain ranges; sometimes it is found in the form of intrusive veins in strata of all ages. At an early period in the history of our planet granite was probably in a perfectly fluid condition and at a high temperature, because, wherever it is found, the rocks adjacent are distinctly altered as though they had been subjected to great heat. The crystalline structure of granite developed as the rock mass cooled, and it is jusually found to be composed of three minerals—quartz, leispar, and mica. These are the ordinary constituents of granite; but hesides these minerals many others occur

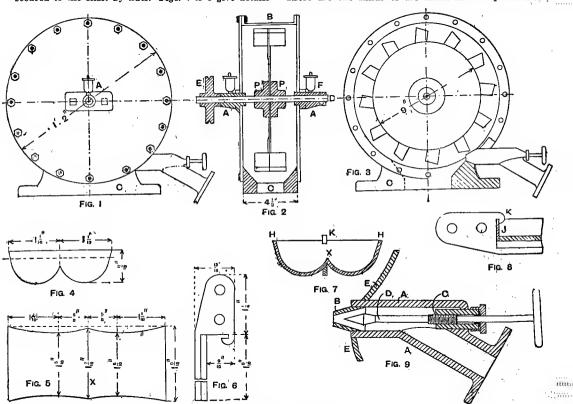
hest stones for all large structures. For harbour work, lighthouses, bridges, foundations, and pillars for large buildings, granite has no rival; the facility with which it may be removed in large blocks from the quarry allows of its heing cut ic almost any size. For ordinary building purposes grantte is not much used, except in towns near where it occurs; but where it is so used, as at Aberdeen, it is found excellent for the purpose, and very beautiful. For monumental work granite is very largely employed because, owing to its hardness, it is able to take a high polish, and some of the varieties are extremely ornamental. The specific gravity of granite lies between 26 and 28, and its composition, though variable, is somewhat nearer the following mean of eleven analyses by Dr. Haughton: Slilica, 72°07; alumina, 14°81; oxide of iron, 2°22; potash, 5°11; soda, 2°79; lime, 1°63; magnesia. 0°33; water, etc., 1°98. The localities where granite is mostly found are Shap, in Westmorland; Mount Sorel, In Leicestershire; Dartmoor, in Devonshire; Aberdeen, Inverary, Oban, Kirkcudbright, in Scotland; County Wicklow, County Wexford, and County Down, in Ireland, etc.

Distinguishing between Chestnut and Oak,—Chestnut is not so heavy as oak, is easier to work, and has a broader grain and quite a different smell. In chestnut, the meduliary rays are not distinct, but the annular rings are very distinct. On the other hand, the meduliary rays in oak are very distinct. Chestnut resembles oak very much in colour. Large quantities of timber are sawn into planks, converted into window eills, gates, wheel-felloes, etc., and sold as oak.

Small-power Water Motor.—Figs. 1 to 3 below illustrate, to a uniform scale of 1½ in. to the foot, the construction of a motor to be driven from the ordinary water supply, and suitable for driving a sewing machine or any light machinery. The capacity of the buckets is sufficient for 20 gal. per minute, and with the nozzle shown in section in Fig. 9 the power of the motor can be varied as required, with little loss of efficiency. The case is constructed of two metal discs of sufficient thickness to carry the two bearings H without vibration. The rim B (Fig. 2) is of sheet metal of about No. 18 s.w.g., with two flanges soldered on as shown, and the back disc is riveted and soldered on as shown, and the back disc is riveted and soldered, and the front one bolted to the flange. The disc and rim of the case may be made of iron, brass, or zinc. The case is fixed to the pedestal c (Figs. 1, 2, and 3), which may be cast in lead, with a central hole to take off the spent water. The shaft p is of ½-in. mild steel, E is the driving pulley, and F a collar. As the efficiency of a water motor depends on the construction of the buckets and nozzle, these will be more fully dealt with. The wheel, of sheet brass ½ in. thick and 9 in. in diameter, should run true on the shaft, and is fixed between the two bosses F, which are secured to the shaft by nuts. Figs. 4 to 8 give details

angle of 13½°. The sleeve c must be of brass tube tapped to suit the spindle p for regulating the flow of water, and must be fitted with a stuffing box similar in construction to a high-pressure screw-down water valve, to prevent leakage. E is a plate of ½-in. sheet brass cut to the width of the casing between the flanges, and to it the nozzle is coldered. This plate fits the rim and pedestal, and is fixed with small bolts and nuts in the position shown in Fig. 3, great oare being taken that the jet strikes each bucket in the centre.

Blacklead, Plumbago, and Graphite.—These are practically synonymous terms for a form of carbon midway between charcoal and the diamond. The first term is probably the original one, and perhaps arose from the fact that the material gave a black mark as compared with a mark made by metallic lead. In practice each term has peculiar applications; thus "plumbago" comes from Ceylon, "blacklead" from Germany, Austria, and Italy, and "graphite" is exported from the United States. There are lead penoils, plumbago crucibles, and graphite lubricants, blacklead stove polishes, plumbago foundry facings, and graphite paint. There are two kinds of the material—amorphous and



Small-power Water Motor.

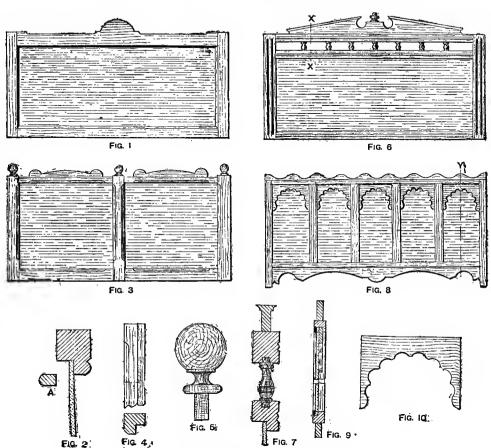
of the buckets, of which twelve will be required. Of sheet brass No. 18 s.w.G., cut twenty-four pieces to Fig. 4 and twelve pieces to Fig. 5; cut also twelve pieces of i.n. sheet brass to Fig. 6, to form the lugs by which the buckets are secured to the wheel. The buckets are built up by bending the pieces (Fig. 5) to the shape shown in section at Fig. 7; the hend at x should be jutie sharp, a knife edge if possible, as at this point the jet is split into two parts, which are thrown off at H, and with a well-designed bucket the water should have no energy left, but should fall away as dead water, the whole of the velocity being imparted to the wheel. Two end pieces (Fig. 4) are soldered to the hent part of the buckets as shown at J (Fig. 8), and the buckets are fixed to the lugs by slipping the catch x (Figs. 7 and 3) over the bucket and soldering the whole together. The buckets when finished are riveted to the wheel as shown in Fig. 3. The nozzle (Fig. 9) may be cast in brass, or the body and flange may be dressed up from lead pipe, the nozzle B being of brass soldered to the body. To get a solid jet, the taper of the opening should be at an

crystalline; the former does not occur pure, but is associated with earthy materials whose character influences the use to which it can be put. Crystalline graphite also shows great variations because of the distortion of the crystals during the process of formation. It occurs both massive and with its particles disseminated through rock; for instance, Ceylon graphite is in large masses of crystals, whilst the American kind is usually found as a small laminated flake disseminated through granitic rocks. Ninety per cent. of crystalline graphite comes from Ceylon, and the same percentage of the amorphous kind comes from Germany and Anstria. The remainder of both of the kinds comes from Canada, New York, and Mexico.

Removing Grease Stains from Ivory.—For removing grease stains, soak ivory handles in best turpentine, letting them remain for a night and a day, and then rub off with whiting. This will bleach the ivory and remove the stains. Be careful not to allow the turpentine to soak into the joints.

Glass Blind Frames.—Glazed blinds are made in almost innumerable shapes, but all are on one principle—namely, a wood frame carrying one or more sheets of glass: this glass is usually obscured or ornamented, but ordinary clear glass with coloured gelatine prints attached, in imitation of leaded glass, mosaic, etc., is employed. One of the simplest frames is made from hardwood picture moulding jointed up by mitres, the glass heing secured in the rebates by narrow wood fillets. No standard measurements for length and breadth can be given, as window frames vary in shape and size all over the country. Fig. 1 shows a very neat blind, which can be cut from boards 1 in. thick. The bottom and side rails may be 2 in. wide, and may be

ment is ½ in. thick and 2 ft. long, with a sweep of 2½ in. to ½ in. at each end. The top is fitted with an overlung cap-mould (see Fig. 7), and with a turned tip in the centre. This blind would be suitable for French polishing if made from hardwood. Fig. 8 is a design in the Anglo-Moresque style, Fig. 9 being a section on Y (Fig. 8); the design is very suitable for enamelling. The whole of the sawn-out part can be set out with a square rand compasses, and Fig. 10 shows one of the semicircular fitments. The blind, it intended for enamelling, can be made of whitewood or canary wood, the framework being of stuff 1½ in. by 1 in., and the fret-worked portions of ½-in, stuff. It is well to know the thickness of the glass before constructing these blinds, as if a heavy



Frames for Glass Blinds.

dressed and rebated all in one length, the rebate being 1 in. by 3 in. The top rail can be got out of stuff 1 in. by 4 in., the inner edges of the frame bearing a ½-in. by 4 in., the inner edges of the frame bearing a ½-in. bead (see Fig. 2). The filling after the glass is put in is done by a separate bead moulding A secured with brads. This design would look well if mahogany or walnut colour. Fig. 3 shows a frame of heavier build than the former, and also divided by a central upright. The stiles are 1½ in. square; the bottom and top rails (Fig. 4) are each in one piece, being housed into the centre piece and stump-tenoned into the ends. The rails are decorated by stock chamiers to within 1 in. of each joint, and the centre upright should be rebated at both sides to receive the glass and fillets. The blind top is finished by three turned wood tips (Fig. 5) and two small shaped pediments. This blind is suitable for being painted black or ebonised if made from hard wood, the chamiers being picked out in gold. Fig. 6 has the popular spindle rail and pediment, the two side pieces, 1½ in. by 1 in. thick, being decorated by stop reeds or flutes, as shown. The three horizontal rails are 1 in. square, and the two lower members only require rebating. The small spindles are ½ in. by 1½ in. long, exclusive of the turned tenons for fixing; see Fig. 7, which is a section, enlarged, at x x (Fig. 6). The pedi-

glass, such as grained or rippled surface, is used, allowance must be made in the rebates, or the fillets will not fit properly. Various methods will suggest themselves for hanging the blinds, such as brass angle-plates, ring and screw, or small brass bolt bars.

Repolishing Black Marble.—Marble is polished by much friction after being brought to a smooth face with sand; first and second, snakestone, putty powder, and polishing lap are the materials applied by means of suitable pads. The dull polish may be revived by dipping a fiannel cloth in a mixture of beeswax and turpentine made to the consistency of ointment, and afterwards polishing with a soft dry cloth; rub briskly. Another cleansing and polishing agent is made of lime water, raw linseed oil, and turpentine, finishing off with a pad slightly damp with methylated spirit.

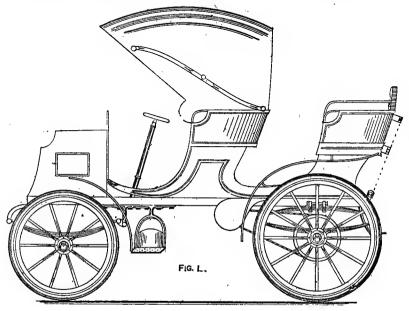
Mixing Paint with Oil or with Gold Size.—Paint mixed with oil and turpentine produces work of a more elastic character; that mixed with gold size and turpentine dries harder, and in less time, and is more fit for cutting down. The amount of driers must depend on circumstances—the less the better, as a general rule. To 1 lb. of mixed-up colour put 1 oz. of paste drier.

Uses of Pure Metallic Sodium.—Chief among the uses of metallic sodium is the manufacture of alkaline cyanides, so largely used in the extraction of gold from low-grade ores and tailings, for electro-plating, in photography, and other minor uses. Large amounts are also converted to sodium peroxide to be used in bleaching wool, silk, feathers, etc., replacing the more expensive hydrogen peroxide formerly used for the purpose. Also, sodium is used in making certain aniline colours and organic compounds, and wherever a powerful reducing agent is needed.

Electroplating Doors, etc.—The carved work, relief decorations, and other enrichments of wooden doors, etc., may by electroplating be given a coat of copper, brass, nickel, or other metal that will in certain circumstances have a very rich appearance. Before plating, the wood is preserved and prevented warping by being coated with linseed oil and resinous gum. Then it is varnished, metal strips as conductors are fixed around the edges, and the whole surface is rendered conductive by blackleading. A big plating vat is re-

a very pale straw colour, provided the original cottonseed oil had been sufficiently well refined by the ordinary process to admit this, and provided the operation had been conducted with sufficient care. Perhaps the most remarkable feature of this filtration by fuller'searth is the different speeds at which oils of different density (in such a mixture of oil as is found in ordinary crude petroleum) will percolate through, with the result that the first oil to make its appearance is not only very much lighter in colour, but much lower in specific gravity. In fact, by this process separations can be made which are quite comparable with the results of fractional distillation.

Motor-car Body.—The smart motor-car body illustrated in elevation by Fig. 1 and here described is designed and constructed from a coach-builder's, rather than an engineer's standpoint; The body is made with round-cornered panelled seats, which are framed, while the panel is grooved in in one piece. The body is framed in sections and strengthened with edge plate, the cutside jointing and screw-heads being covered with \(\frac{1}{2}\)-in, maho-



Motor-car Body.

quired, and the operation of depositing the metal is carried out as usual. The excellent fire-resisting qualities of a wooden door covered with tin plate are recognised, the metal preventing the wood taking fire and the wood framing preventing the door warping from the heat and allowing flames to pass through, this last being a defect of doors made wholly of from. A tinplate covered door has a poor appearance, however, and is suitable only for workshops and warehouses. An electrically deposited coat of metal serves the same purpose as the tin plate, and the process is suitable for doors in all situations.

Refining Oils with Fuller's-earth.—Florida fuller's-earth, ground to sixty mesh and finer, is used as a substitute for bone black in filtering mineral lubricating oils, although its use has been somewhat extended for the lightening of the colour of cottonseed oil. The common practice is to dry the earth carefully, after it has been ground, and run it into long cylinders, through which the crude black mineral oils are allowed to percoalate very slowly. As a result, the oil which comes out first is perfectly water-white in colour, and markedly finner than the oil that follows. This continues percolating through the fuller's-earth until the colour reaches a certain maximum shade, when new earth replaces the spent material from which the oil is afterwards recovered. With the vegetable oils the process is radically different. The oil is heated in large tanks to above the boiling point of water, and from 5 to 10 per cent. of its weight of 'fuller's-earth is then added, and the mixture vigorously stirred for twenty minutes, and then passed through bag filters. The colouring matter remains with the earth, leaving oil of

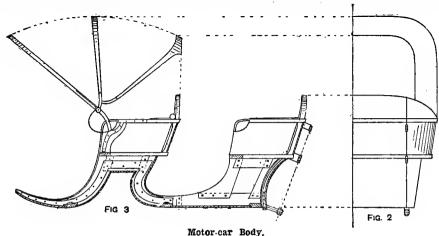
gany panelling. The car will carry four persons, and the hood falls down and rests on side props, to which the hinged side joints are roller-fitted to allow of their working with the head. The back and front wheels are fitted with wing mud-guards, and the hind springs are fitted with wing mud-guards, and the hind springs are elliptical, while the front ones are grasshopper shape and attached to scrolls. The front scroll is made with a rigid jaw, and the back one is spindle-forged and a shackle is fitted to it, which allows the spring to lengthen when deflected by the weight. The motor box and frame are supplied by motor engineers to their standard sizes, which should be ascertained before making the body. The hind part of the body is made to open, so that getting in and out of the vehicle is much simplified. The height from the seat to the roof of the head should not be less than 3ft. 4 in., and sideways the head should come well over the edge of the motor box, so as to protect it as much as possible; 3 ft. 8 in. is the width in this design. The length of the front seat is 1 ft. 5½ in.; the depth over the iraming mouldings is 9½ in.; the length of the top rail, 1 ft. 8 in.; width of top rail, 3 ft. 7 in., and the width across the seat, 3 ft. 4 in. The door, 2 ft. 4 in. wide behind, is framed and panelled over, and is very carefully hung on butt and outrigger bottom hinge. The body framing should be of \$\frac{1}{2}\$-in. English ash, covered with \$\frac{1}{2}\$-in. mahogany panelling. The head cod joint and pillar plate are forged in one piece, to which is fitted the head slat hinge feet. The body should not be less than 2 ft. 8 in. on the bottom and 2 ft. 11 in. on the top, and the hind and front seats project over the sides of the hody, as shown in Fig. 2. The inside elevation (Fig. 3) shows the method of framing up and of plating the body, and the position of the cross-bars and bottom panelling and boarding is illustrated.

trated. The height of the hind wheels is 2 ft. 8 in., and of the front wheels, 2 ft. 6 in. The top of the frame is 2 ft. 2 in. from the ground, and the length of the hind springs is 2 ft. 7 in., the span being 7 in. The front springs are 2 ft. 4 in. long, the hind scrolls 5 in. deep, the front scrolls 3½ in. deep, and the springs are 2 the wide, the number of plates in the hind spring being eax, and in the front spring seven. The illustrations are to a scale of ½ in. equals 1 ft.—that is, the measurements on the drawings are one-twenty-fourth the actual size.

Gums: Benzoin, Elemi, Arabic, and Tragacantb.—Gum benzoin or benjamin is obtained from Slam and the Malay Archipelago, and is the product of the Styrax benzoin. Benzoin is a peculiar looking resin, occurring in very large blocks, the ground mass of a grey or brownish colour indented with amygdules or almond-shaped particles of a cream colour; it is a soft resin, but rather brittle and easily pulverised even between the fingers; it has a pleasant fragrant odeur. Benzoin is used only for glazing purposes, or for imparting a gloss to varnishes, but the film it forms has no durability. Elemi is used occasionally in varnish making for softening the film, counteracting the effect of brittle resins when they are also present. Gum arabic is a product derived from several species of Acacia growing in parts of Africa,

the result. The drying oils and the fish oils have high bromine absorptions, while on the other hand the absorptions of the non-drying oils are low. In the second place, the purity of an oil may be determined by this method: The bromine absorption of linseed oil being 76, any addition of cotton-seed oil (br. absorption, 50) or other vegetable oil would lower this figure; resin oil or mineral oils, absorbing little or no bromine, would lewer the absorption considerably.

Manufacture of Pale and Orange Chromes.—
The chrome yellows are prepared by mixing together solutions of lead acetate and blchromate of potash, together with other reagents necessary to obtain the desired colour. The precipitation is carried on in three tubs, two of which are raised upon a platform, and are fitted with steam pipes for heating purposes, the third tub, which is larger than the other two, being placed upon the floor. Water is peured into each of the two smaller tubs; the requisite quantity of bichromate of petash is placed in one, and of lead acetate in the other; the steam is turned on until solution of the salts is complete, and the liquids are then allowed to become quite cold. The two solutions are now run into the larger tub, and are well stirred, the separated chrome colour rapidly settling to the bottom of the tub; the upper liquid is then syphoned off, and the pigment well



India, and Australia. Gum arabic occurs in small rounded nodnies, or in pipe-like pieces, sometimes colourless, hut usually pale yellow to brownish yellow in colour; it is very brittle, and usually transparent. Gum arabic dissolves readily in cold water, forming a viscous liquid; it is insoluble in spirit, and is pre-tipitated from solution in water if spirit be added. Gum-arable solution is used as a glaze and medium for ticket-writing. An inlerior gum, known as "gum ghatti," comes from India. Gum tragacanth or dragon is the product of certain species of Astragalus growing in Palestine and Turkey-In-Asia. It occurs in peculiar leaf- or moss-like pieces of a milky-white or greyish-white colour; it is opaque, hard, and tough. Treated with water it swells up, forming a very thick emulsion or mucilage, but this cannot be described as a solution. The liquid is sometimes used in place of gum arabic.

Testing Oils by Bromine Absorption.—Before determining the bromide absorption of an oil, certain standard solutions have to be prepared: these are:—(1) Standard solutions have to be prepared: these are:—(1) Standard solution of bromide in carbon tetrachloride ('006 or '008 in 1 c.c.); (2) Solution of \$\eta\$-naphthol in carbon tetrachloride; or standard solution of seadlum thiosulphate (1 c.c.) = '007979 gram br.). The oil is first thoroughly dried by heating in a dish and then filtered. O'l gram of it is then weighed out into a narrow-mouthed atoppered flask of 100 c.c. capacity, and dissolved in 50 c.c. carbon tetrachloride; the standard bromine solution is then run in from a burette until a permanent coleration, due to excess of bromine, is perceived. The excess of bromine is then determined by titration with the standard \$\text{-naphthol}\$ solution, or potassium iodide is added and the liberated iodine titrated with the standard solum thiosulphate solution, the amount—calculated to bromine—is deducted from the total bromine added, the result being the bromine absorbed by the oil; the bromine absorption is then calculated on 100 grams of the oil. In the first place, the class of oil to which the sample belongs may be deduced from

mate $2KC_2H_3O_2 + 2HC_2H_3O_3$ potassium acetic acid

notetate active active

mate ric acid

= 2PbCrO₄PbSO₄ + 2K₂C₂H₃O₂ + 6HC₂H₃O₂
lemon chrome potaesium acetic acid acetate

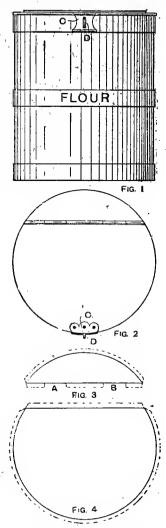
For preparing orange chromes, either a lemon chrome is produced, and afterwards treated with caustic soda or lime, or canstic soda or lime are added during precipitatien. These reagents form, according to the amount added, a more or less basic chromate of lead varying from pale orange to dark red. The following equation gives some idea of the reaction:

2PbCrO₄ + NaHO = Na₂CrO₄ + PbCrO₄PbO chromate caustic sodium chrome orange

sodium chromate + $\mathbf{H}_2\mathbf{O}$. of lead seda

Reducing Size of Horse's Collar.—This can be done as follows: Open the top, remove the top piece, and then, with pincers, pull some wisps from the straw in the forewale until both sides meet easily. Now stitch the ends together to the required size, turn down the side piece and lining, cut the straw in the body to size, fasten both ends of the body together, and put the side plece on as before.

Sheet Metal Flour-bin,—The sheet metal flour-bin shown in elevation by Fig. 1, and in plan by Fig. 2, can be made of No. 24 B.W.G. tinned iron. The pattern for the body is simply a rectarigle, equal in length to the circumference, and in width to the proposed depth of the bin, plus working edges. Pass this through the rollers to "break" the metal, off the ends set two edges for a grooved seam, and edge the top to take ½-in. rod iron. After wiring, turn to shape, groove the seam, and solder it inside. Make two hoops of tinned hoop-iron to fit tightly round the bin, drive one up to the wired edge, and solder it in position, and fix the other similarly in the centre. Now set off an edge for the bottom,

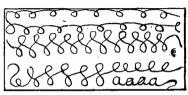


Sheet Metal Flour-bin.

which is paned on and beaten np. Make another hoop to fit the bottom of the bin tightly, drive it on, but allow it to overhang the bottom about 1 in., and then solder round the top edge of the hoop, and float about four bodies of solder underneath the bottom at equal distances apart. The top or cover of the bin is made of two parts, hinged together, the patterns for them being shown at Figs. 3 and 4, where the dotted lines represent working edges. First cut out the back portlon (Fig. 3), and notch it at a and B for the linges. Wire the straight edge with in nod-iron, sink it in the crease iron, and bend it over to form a feather edge. Two straps of metal equal in width to that of the notches and B are bent over the exposed wire and sunk in the crease iron, and thus form the hinges. The other edge is set off downwards, and is fitted to the back part of

the top of the bin, to which it is then soldered. Fig. 4 is next cut out and wired, the edges being represented by dotted lines; place this piece on the bin, resting on the hinges of the other part, and solder them together. Then lift the cover and solder the hinges nnderneath also; these may be further secured with a couple of rivets through each. A hasp c (Figs. 1 and 2) is then riveted on the cover, and a plate and staple D are riveted on the bin. Clean with turpentine and whiting, and finish with dry whiting. A bin of this description is usually painted oak colour, except at the hoops, which are painted black, and on the central hoop the word "flour" is gilded.

Hints on French-polishing.—In French-polishing, dnll corners and edges sometimes occur. To prevent them, keep well np in the corners and on the outside edges; the middle will take care of itself. A clean, bright finish on every portion stamps the worker as consolentious, and to achieve this end it is necessary to have tools in first-class condition. If the polish is carelessly laid on, or the rag covering has creases that leave the polish in ridges, or the polish rubber is in a shape that will not reach well into the corners, quirks, hollows, and edges, much unnecessary labour will be wanted in grinding down with punnice. The rag covering of the polish rubber should be free from creases, and to gain a clean, level finish it should be kept in good shape, with a sharp point, soft and pliable, always charged with polish or spirits; in fact, it should be always doing comething, either laying on polish or bringing up the lustre. As far as possible the work should be taken apart for polishing, panels being removed to enable them to be fixed on the hench and worked up separately; but where this taking apart is impracticable, aim at getting the polish evenly distributed over all portions, and, if needful, coat the extreme edges and corners with equal parts of varnish and polish, or wipe the tip of the glaze rubber over these



Hints on French-polishing.

parts previous to spiriting out. Let each stroke of the rubber overlap the former, and avoid working in too straight lines; circular movement is often advised, but those who have watched an experienced polisher at work will note that the strokes closely resemble figure 8's, letters S, and small a's, as shown in the illustration. Varions materials, including wool, flannel, cloth, felt, and wadding, are often advised for laying on the polish, but white or grey wadding is most used in the trade. Keep the rubber in good shape, not allowing it to get round, otherwise bright, clean corners will not result. Therefore twist the rag at the point and back on the top of the rubber, keep the index finger well over the point, and press the thnmb well on the side with the snrplus rag grasped well in the palm.

Painting with Pure Vermilion.—When doing this, be most careful in preparing the ground and in selecting the materials for the under coats. There are many reds used as under coats, but on the finishing vermilion, they all have a deleterious effect. The use of Chinese red (a coarsely ground and gritty pigment), Persian red (a dnll, unpleasing colour), Venetian red, or more especially red-lead, is a very great mistake. These colours may possibly be used when the finish is for temporary work only, but never as a ground for vermilion. With the cheaper class of imitations such as vermilionettes, the colour, no matter on what ground, will turn a dirty, disagreeable, washed-ont pink; and no matter how expensive or how pure the genuine vermilion, the action of the cheap reds, such as those above mentioned, will have the same effect in a very short time. When the genuine material is found in a month or two to show signs of fading or of losing the richness and brillancy which characterise it, the fault is directly traceable to the under coats, and the painter and not the mannacturer is to blame. Gennine white-lead of the best quality, without any tinted material, is the only safe ground to use, and should not be stained with any other pigment even in the slightest degree,

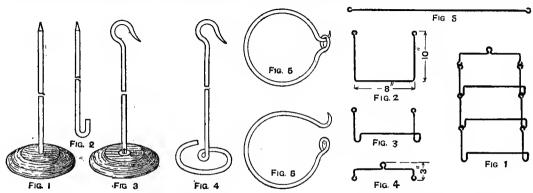
Definition of a Lens.—A lens may be called a series of prisms of gradually increasing angle, all converging the incident light towards one point, its focus.

Measuring Slater's Work.—It must be understood, when measuring up a roof in order to calculate the number of slates required to cover it, that more than one-half of a slate is covered up, and consequently every part of a roof has at least two thicknesses of slate, and three thicknesses where the lap proper occurs; that is to say, a roof requires more than double the quantity of slates that would be necessary to cover it if they were spread out side by side. Therefore, to get the quantity of slates in a course, divide the width of a slate into the length of the roof; then divide the exposed length of the elast into the width of the roof; by multiplying both together, the superficial quantity is given; double this, and add the lap of each course. Under-eaves and top-course slates should be counted as full slates; stacks under 4 ft. are not allowed for, as the time used in cutting around offsets the quantity of slates not used; and hips, valleys, etc., should be measured for length in the centre of roof, and about 1 ft. extra allowed for cutting.

Wirework Memoranda Files.—The files illustrated in Figs. I to 6 are of the simplest form of wirework, Fig. 1. showing a small desk file from 6 in. to 8 in. high. Fig. 2 illustrates the method of sharpening the wire (No. 11 B.w.G.) and how the bottom portion is turned up to fasten into the small wood block. The latter may be purchased for a small sum from any wood-turner. Cut off the necessary wire, file it to a point with a coarse file, and then finish with a fine one, so as to get it as smooth as possible. Next with a pair of round pliers bend the end as shown at Fig. 2, bore a hole in the wood block, push the wire through and tap it with a hammer, being careful

lengths to accuracy. For work that butts, a straight-edge with a steel edge to it and a trimming knife are necessary. Many manage to do the work with a pair of scissors, but in that case the edges never meet accurately; a roller is also of service to rub the edges well down. A roll of paper held in the left hand is useful; it helps to hold up the limp pasted lining-paper when applying it to the ceiling, leaving the right hand to fix the paper to the joint. It is then easy to sweep the paper up with the roll in the left hand, continuing to butt or lap the paper with the other hand. When the paper is pasted and folded, take in the left hand the roll that is being used to help lay the pasted paper, and place it under the middle of the paper; then unfold the right end of the paper, which should be the shortest fold. In this way carry it up the steps. The short way of the ceiling allows shorter and more manageable lengths to be hung, but the lap should be away from the light, so as to be less perceptible. Begin at the light, and work away from it so that the laps do not show. Some prefer to lap the paper, as it is less liable to curl up from the ceiling than when it is butted.

Making Wirework Racks for Newspapers.—A simple paper or letter rack such as is illustrated by Fig. 1 may be of any size, may have any number of hangers, and may be made of tinned, coppered, or brass wire, but if of the last it should be dipped and lacquered after being made. The dimensions given in Figs. 2 to 4 are for a newspaper rack, the wire required being 1 lb. of No. 11 B.W.G., or a stronger size if preferred. The tools needed include a pair of round-nosed pliers and a



Wirework Memoranda Files.

Wirework Racks for Newspapers.

not to split the wooden block by hitting it too hard. Fig. 3 illustrates a similar file with the addition of a hook at the top, so that it can be hung up. Fig. 4 is an all-wire file. To make it, cut off a piece of wire 18 in. long, straighten it, sharpen the point and form a hook, then twist the ring at the bottom so that the wire lies across the centre of the ring, and bend the file so that it is vertical and in the centre. Figs. 5 and 6 show a very useful ring file that can be hung up, and yet when placed on the desk or table is out of the way.

Repairing Ceilings.—All holes in plaster, cracks, and bad places of every description should be cut away, with the indentation bevelled towards the ceiling. A V-shaped cutting to help to give a hold to the mending stuff is what should be adopted. The holes thus made should be filled either with a mixture of white chalk, lime putty, and plaster-of-Paris, or with Keene's cement; sometimes the holes are mended with plaster mixed with glue size. The opening should be well wetted first, and the filling well pressed in. The trouble in a mended ceiling consists in the fact that the new plaster is more absorbent than the old, and is likely to show in the finished work. Where mending has taken place, an extra coat of size should be given. In the case of a very cracked, or even new, ceiling, it is a good plan to line it—that is to say, lining-paper should be pasted on to the ceiling in lengths towards the windows. Some like to lap the edges of the paper, some to but the edges, but the aim in each case is to make the joints quite level and inconspicuous. If the joints are butted, a liftle filling up is required; if lapped, they require to be rubbed down with glasspaper or a flat cork. The great object is to hang the paper smooth and straight. Very much depends on the laying of the first length. It must be laid perfectly true to a straight line; the other lengths will then follow straight. A straight line, struck by means of a chalk line down the centre of the space to be lined, will serve as a correct start and hold all the other

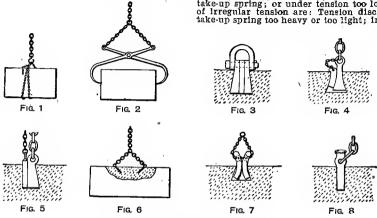
pair of cutting nippers. Cut off three pieces of wire, each 2 it. 6 in. long, and turn an eye on each end, as at Fig. 5; then bend the wire to Fig. 2, and again bend on a wooden roller about 2 in. in diameter, so that the eyes stand well above the front portion, as in Fig. 3. Next cut off one piece of wire, 1 it. 6 in. long, to form the hanger (Fig. 4), and use the same wooden roller for the loop in the centre, and bend the wire back to shape with pliers; then turn the eye at each end and bend the sides down. To put the rack together, simply hook the hangers on each other and close with pliers.

Varnish Blooming or Clouding.—Blooming or clouding of varnished surfaces is due either to injurious gases or to a chill caused by working on a surface colder than the surrounding atmosphere. It may sometimes be removed by rubbing the dry varnish with a mixture of oil and vinegar, afterwards wiping the surface thoroughly dry. Flatting may be caused by soft under coats. To prevent these troubles the under coats should be allowed to dry right through, and foul air must be avoided and draughts prevented in the room where the varnishing is being done. Cracks in the first coat of varnish on marbled papers, and on grained work, are due to the different nature of the two grounds. In newly grained woodwork, cracks may occur if the under coat is not hard enough; or unequal contraction may be the cause. The remedy is a fresh coat of varnish, when the cracks will disappear. Other causes than those above mentioned are smoke fumes, change of temperature, and moist atmosphere; the remedy is to rub down the work and give it another coat. Pitting is caused by uneven temperature during drying, or by ammonist times; also by mixing varnish of different grades, or by varnishing over a "sweaty" or still moist surface. Pitting may be prevented by allowing the varnish to stand for a couple of hours before using it, by damping down the surface with a chamois leather, and by obtaining as far as possible an even temperature when varnishing.

Principle of Spectroscope. — The spectroscope is an instrument consisting of prisms and lenses so arranged as to separate the various kinds of light into their components, and permit the examination of these components. Under proper conditions every element emits a light that is peculiar to it. Thus, when gases in a rarefied condition are subjected to the discharges of an induction coil, they glow and send out rays of different colours, which, viewed through the spectroscope, betray the chemical nature of gases. To this end, the specimens to be examined are enclosed in glass tubes provided with platitrum wires at both ends and contracted in the middle to a fine capillary; these are Pluccker's tubes, named after their inventor. On connecting the wires with the terminals of a coil, the electric discharge passes through the gas, and the glow appears most brightly in the capillary part of the tube. For Instance, hydrogen gas so treated glows and is recognised instantly by three characteristic lines in its spectrum, one red, one blue, and one violet.

Gripping Stone Blocks for Hoisting.—Fig. 1 shows the common method of lifting any load by a sling chain. Blocks of stone are apt to be chipped by this method unless strips of wood are inserted to keep the chain off the edges. Fig. 2 shows lifting tongs, commonly used for raising Bath or other soft stone blocks; the heavier the load the tighter the grip naturally produced. Fig. 3 shows the common lewis in a dovetailed mortise for lift-

spring acts too long; needle set too low or too high; shuttle too fast or too slow in its movement; shuttle point blunt or bad shape; shuttle or hook or roll presser too far from the needle. In some machines the shuttle or hook is made adjustable, but, when this is so, care must be taken not to set it too close to the needle. Where the shuttle is not adjustable in this way, the arm of the machine must be moved. Before doing so, be sure the needle is straight, and the shuttle not worn so as to fall away from the needle. If there is any doubt about it try a new shuttle. The causes of the upper thread breaking are: The needle being too small; the needle-plate hole being too small, rough, or sharp; the shuttle or hook sharp; the variable motion not correct; any place where the thread passes through, as the thread guides, etc., being rough, cut, or sharp; not enough play for the thread hetween the shuttle and driver; the tension too tight; or the needle boto high. Breaking of the lower thread is caused by the needle plate and casting; or the shuttle being sharp; where the thread is delivered. Looping (underneath) is caused by: A broken take-up spring; tension too loose on top; notches in the need to shigh or of too light a pressure; needle-plate hole too small; needle jammed on one side of needle hole; heel of the shuttle; incorrect variable motion; take-up spring too high or of too light a pressure; needle-plate hole too small; needle jammed on one side of needle hole; heel of the shuttle; incorrect variable motion; or take-up cam roller worn out. Looping (on top) is caused by: Tension too loose; broken take-up pring; or under tension too loose. The causes of Irregular tension are: Tension discs or stud worn; take-up spring too heavy or too light; incorrect variable



Gripping Stone Blocks for Hoisting.

ing hard stone. This takes apart in several pieces. The plug consists of three parts, and is fixed by first inserting the taper pieces, then the parallel piece, which pushes the others into the dovetailed recesses; the shackle is then placed over the top, the pin put through, and the cotter or spllt pin in the end. It is removed in the reverse order for insertion in the next stone. Work finished hefore holsting is often lifted in this way, as the ends and sides are not llahle to damage. Fig. 4 shows a somewhat similar arrangement, but without any loose parts. The mortise is curved and cut deeper than the plug, so that when the plug is down at the bottom the key can be inserted, while the lifting of the plug puts it all tight. Fig. 5 shows the application to suhaqueous work, where, by a separate chain to the surface of the water, the key can be withdrawn after the stone is lowered into place. This figure shows a better form for the plug and key than Fig. 4, and equally suitable if the small chain be left long enough to withdraw the key. Fig. 6 shows the arrangement of lifting plus for granite. They are inserted loosely into inclined mortises, and hold the stone securely when the lifting chain is tightened. Fig. 7 is simillar in principle, but arranged differently. Fig. 8 consists of a plug with a slight taper driven firmly into a parallel hole in granite, being loosened by a few side hlows after the stone is set. This is not safe to use singly, and is better when two are used, as the bridle chains then pull the tops together instead of pulling straight from the mortise.

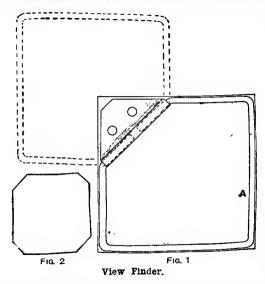
Causes of Failure in Sewing Machines.—Of the various causes of machines working improperly, missing the stitch is the most common. A few of its causes are here enumerated: Bent or imperfect needle; bent needle-bar; needle not set straight in har; needle etrlkes the side of the presser foot or of the needle plate; hole in needle plate too large; needle too large for cotton; not enough pressure on presser foot; take-up

motion; shuttle carrier too far forward; insufficient opening between the shuttle and carrier; shuttle tension spring worn; bobbin-retaining spring too heavy or too light; bobhin too loose in shuttle; hobbin case holder or fork too near to bobbin case; shuttle or hook too late; shuttle too loose; or shuttle notched in neck. Drawing thin material into gathers results from: Tension or take-up spring too tight; presser foot cut by feed; feed too high or too sharp; or roll presser sluggish.

seasoning Deal.—There are three methods in general use for seasoning deal; the processes are as follows:

(1) That known as natural seasoning. The deal is stacked under an open shed in such a way that the air can freely circulate round each piece, gradually evaporating the sap and moisture. Care must be taken that the pieces shall lie out of winding, and they must be occasionally turned so as to ensure equal drying. It is also important that the timber should be protected from high winds and the sun's rays, which would dry it too quickly and cause shakes. The processes must be continued until almost all the sap and moisture are extracted before the wood can be considered thoroughly seasoned. (2) The system of seasoning known as McNeile's. The timber is stacked with free space between the pieces in a chamber in which there is a large surface of shallow water and a furnace under. On the fire heing lighted, the heat produces steam, which, together with the fumes of combustion, circulates freely round each piece, causing it to give off its sap in much less time than by the natural method, and yet without cracking or warping. (3) Hot-air seasoning Small scantlings. It is carried out by stacking the timber in oven-like chambers heated to about 90° F. Waste steam from engines is frequently utilised for this purpose. Care has to be taken to regulate the heat so as to prevent warping and splitting.

View Finder for Snapshot Camera—The finder to be described was originally used on a Brownie camera. It consists of a piece of wire A (Fig. 1), bent in the first instance in the form of a square, 2½ in. by 2½ in.; the ends of the wire meet at one of the corners, and at 1½ in. from the ends are then turned inwards at an angle of 45°. A small piece (Fig. 2) of tin or sheet-brass, about 1½ in. wide, is then folded round wire of the same size as that used in making the square, and forms a hinge; the two ends of the wire are then inserted in it, and the hinge is fastened to the right-hand upper front corner of the camera. Out of use the finder lies against the front, but when being used it stands out from the camera, and when looked at from the back of the camera has the appearance of a square with the bottom left-hand quarter blocked out by the camera. This should be held to the eye, so that the latter can look along the right-hand upper edge and the back close to the face; the wire frame will then include all of the view that is being focussed upon the film. Allowance, of course, has to be made for the quarter which is hidden by the camera. It is obvious that this attachment can be adapted to any camera if due account be taken of the size of the film or plate and of the focus of the lens. Set this out on paper as follows: Draw a horizontal line through the centre of the lens, and set up a perpendicular line at a distance equal to the focus of the lens from the point, make the lengths of the perpendicular line above and below the horizontal line each



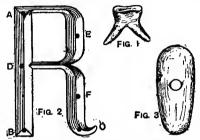
equal to one-half the height or width of the plate being used, and from the centre point draw lines cutting the end of this perpendicular line. Along the horizontal line measure a distance from the centre point equal to the length of the side of the camera, and set up a perpendicular line cutting the two converging lines. The length of this last perpendicular line between the converging lines is the length of the side of the wire frame. When the plate is not square, a similar plotting is necessary for the length of the other sides.

Phonograph Records of Celluloid.—This material appears to be suitable if specially treated. According to one process, a cylindrical matrix contains on its inner face a cast in reverse of an original sound record, and inside this is inserted a celluloid cylinder, the two cylinders together then being immersed in alcohol or the commercial "celluloid thinner," but preferably in amyl acetate, until the surface of the celluloid has become softened. They are then removed from the solvent and allowed to dry, care being taken that there is no slip between the two cylinders. When the celluloid is softened by the solvent it expands and wholly fills the matrix, and it can resume its normal condition only by the evaporation of the solvent. The solvent is prevented from evaporating from the exterior surface of the celluloid cylinder, and can escape from the inside surface only. Consequently the whole Interior surface shrinks back from the centre towards the matrix, drawing back and contracting the whole thickness of the cylinder wall. As each particle of the solvent from the outer surface of the celluloid cylinder and each particle throughout the mass of the same passes out, its place

must be taken by an equivalent particle of celluloid. Hence the celluloid material is packed closely against the matrix surface, so that when the celluloid has resumed its normal condition the cylinder is of slightly larger diameter both externally and internally than originally. When the celluloid is thoroughly dried, it is separated from the matrix, and its outer surface then is a faithful copy of the original sound record.

Artificial Ice Flowers.—A process said to produce imitations of ice crystals is as follows: Make a 2 per cent. solution of the best and clearest gelatine in distilled water, filter, and flood the filtrate over any surface to be ornamented—a plate of glass, for instance. Drain it alightly, and if the weather is sufficiently cold, put the plate, as nearly level or horizontal as possible, out into the cold air to freeze. In freezing, water is abstracted from the colloidal portion, which then assumes an efflorescent form, little flowers with exuberant graceful curves of crystals showing up as follage all over the surface. To set these in permanent form, flood them with absolute alcohol. This treatment removes the ice, and leaves a lasting framework of gelatine which may be preserved indefinitely. In order to do this, however, as soon as the gelatine has become quite dry it should be coated with shellac varnish, or it may be rendered insoluble by contact for a few moments with a solution of potassium bichromate, and subsequent exposure to

Lead-lettering Monumental Work.—In the first place the letters should be cut deeper than ordinary, so that their bottoms may be brought to a more acute angle; they should he brought in section to a sharper V than in other lettering. They are not undercut, hut are, except in the above respect, cut as ordinary letters.

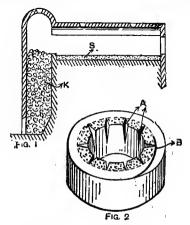


Lettering Monumental Work.

The hold of the metal on the stone is secured in much the same way that nature fixes the double teeth in the jaw (as roughly shown in Fig. 1). By means of drill holes the lead is made to slant out in all directions from the centre of the letter. Thus in the R (Fig. 2) the hole at A would slope upwards, those at B and C would slope downwards, D would slope to the left, and E and F to the right; the number of holes to be drilled depending, of course, on the shape and size of the letter. In the case of granite, instead of a drill a punch is used for making the holes, and worked round under the hammer so as to pulverise the stone—a slow and tedious operation, which tends to make lead lettering in granite expensive. As to the material, lead wire is used. Some letterers, however, prefer to use the best sheet-lead, employing a lad to cut it to shape and size for each letter, as wanted. This, they says, makes a better job, joinings in the lead, which are never satisfactory, being thus avoided. For hammering in the lead a patent hammer is sold, and does its work satisfactorily, but it is easy for the letterer to make his own hammer from a bit of box wood. Fig. 3 shows a good shape. It is about 4 in. long, the ends are rounded, the larger one being about 1½ in. across, the smaller about 1½ in. The lead must be thoroughly hammered into the holes, or the work will not stand. When this has been done, the superfluous metal is best pared off with a sharp wood chiest, slightly rounded at the corners, so as not to scratch; after which the lead and marble must be rubbed down to one perfectly true plane. Many do this with cream grit and a little water, but a better thing is Gotland grit, which is somewhat more expensive, but which, biting equally on lead and marble, does its work more effectually.

Uses of Ozone.—Ozone is used on a commercial scale in yielding organic oxidation products, in sterilising water for potable purposes, and in bleaching fabrics. Among its proposed uses may be mentioned the decoloration and clarification of syrup in sugar manufactories, the ageing of wines, and the ageing of woods for the construction of such musical instruments as violins.

Portland Cement Manufacture. — At a cement factory on the Medway, the constituents of Portland cement are clay and chalk, the chalk being obtained from the neighbourhood, but the clay having often to be brought some distance. Both are carefully weighed, and are mixed in varying proportions, according to the results of frequent chemical analyses. At the time of the writer's visit the proportion of chalk in weight was 20 cwt. to 8 cwt. of clay. After weighing (the clay having been tempered and the flints removed from the chalk) the materials are tipped into a surry mill and mixed with water until thin enough to run through gratings into a pit, whence the stuff is lifted into the wet mill and ground to a certain degree of fineness. It is then pumped into a long arched chamber with a kiln at one end, where it is spread to a depth of 8 in. or 10 in., and dried by the spare heat of the kiln that is burning the previous batch of slurry into clinker; the heat from one batch drying enough slurry for the next batch, which is broken up and put into the kiln with a carefully calculated amount of coke. The quantity of the coke is an important factor in the burning, and much practice and experience are required in order to ensure the clinker being burnt to the right point. If overdone the cent will not attent the ultimate strength that is possible when the clinker has been, as it were, "done

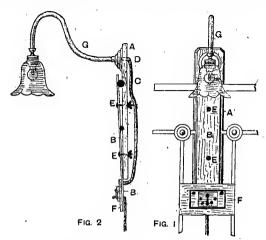


Portland Cement Manufacture.

to a turn." After burning, the clinker is removed to the dry mill, where it is broken to a uniform size in hoppers, shaken into the mill at a constant rate, ground to the extreme fineness by which it is characterised, passed through a tube to the packing shed, and packed into harrels-or bags according to requirement. In this manufacture the points needing the greatest caution are the careful exclusion of flints, the burning of the dried slurry, and the grinding of the burning of the dried slurry, and the grinding of the burning of the rate is exercised to prevent flints going with it, as many as 2 cwt. and 3 cwt. have been taken out in one week. They are found to be worn to almost a round shape, owing to the rapidity with which the wheel revolves. Consequently, pieces of flint no bigger than a pin's head, escaping through the grating, increase the difficulty of grinding. The millistones (Fig. 2) are of a peculiar shape. The clinker is forced up and into grooves A, and is worked towards the edges in the direction of the line. If a piece of grit or flint should cut into the stone, it would form a groove B, into which pieces of clinker of a similar size would go, and escape grinding. It is such pieces that are apt to "blow" after work has been completed. The stones of the dry mill, though not so liable to be scored as those of the wet mill, still have to be faced pretty frequently, and this operation takes a considerable time. Rock emery stone, said to be self-facing, is being introduced, and is supposed to be harder than the French Burh, which has been much used on the Medway. After burning, the clinker is removed to the used on the Medway.

would indicate the ends of a line itself; "a b" would indicate the plan of the line A B and "a' b'" would indicate the elevation of the line A B. Lines consisting of a number of alternate short and long dashes are projector lines or "projectors"; they are employed to projector lines or "projectors"; they are employed to show the connection between corresponding points of plan and elevation. Lines consisting of a number of successive short dashes or dots are used to indicate a line that is hidden from actual view because it is behind some portion of the solid of which it forms an edge. Lines without break, "full" lines, are used to represent the visible outline of a solid in plan and elevation. Where special parts of an outline are raquired to be distinguished from the rest, the lines at those parts may be thickened to make them prominent.

Simple Electric Night-light.—An easily made night-light which is supplied with current by five primary batteries, and which may be clamped firmly to the bedstead, is illustrated in Fig. 1. The fittings consist of the bracket, a length of ½-in. brass tubing half a dozen brass terminals, two brass botts with thum nuts, a bayonet holder with shade carrier, a shade, and a length of No. 22 s.w.c. twin flexible wire. For the back of the bracket procure a piece of ½-in. wood A (Figs. 1 and 2), mahogany preferably, 1 ft. 5 in. long by 33 in.



Simple Electric Night-light,

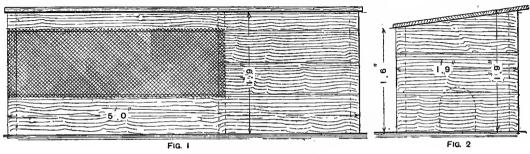
wide, and a piece of the same length B, but 5½ in. wide and ½ in. thick. Plane them up, trim the edges, and cut two grooves c in each for the rails of the bedstead. At 2 in., 7½ in., and 1 ft. 2 in. respectively from one end of the ½-in. piece, drill ½-in. holes, the first D for the wires to and from the lamp, and the others E for the clamping bolts. In the ½-in. piece, at 5½ in. and 10 in. from one end, similar holes must be drilled. This piece must be placed 4 in. lower (see Fig. 2) to take the switchboard F, which may be 7 in. long by 4 in. wide and of ½-in. stuff. The switch will hardly pay for the making and may be bought for 3d. Fill the ½-in. brass tubing with restin melted, and, holding it between clamps of lead or other soft stuff in the vice, bend it to a swan's neck shape G (Fig. 2). Then melt out the resin and screw each end for about ½ in., obtain a brass socket similar to those used on gas brackets, and screw on one end of the tube, this in turn to be fastened on the backboard A with three round headed brass screws. The other end of the pipe will receive a bayonet holder fitted with a shade carrier. The lamp must be a 4-voit high efficiency B.C. (bayonet-capped) lamp. Many will favour the dry battery, which, though requiring no attention, is raiher expensive, for when run down it must be replaced by fresh cells. The Carporous Leclanche cell has a very quickly recuperates tiself. Five such cells may be used giving collectively 5 or 6 volts. Scrape the zinc rods now and again, say every six or nine months. In fitting up, place the cells on a dry and alry accessible shelf, and in wiring start with the holder; fasten each of the wires, ends bared, to the inside screws, then lead them down to the switch and take lengths to the terminals of the battery. The above is, of course, for intermittent lighting only, and will last for about fitten minutes at a time. If desired, any number of lamps can be fitted up, but one only can be alight at a time, using a two- or a three-way switch as wanted, and leading t

Preparing Ironwork for Painting.—In the application of paint to ironwork, the first thing to be done is to get the surface absolutely free from rust. A mere scrape with a knife will seldom be sufficient; a good scrubbing with scratch-brushes (that is, brushes with wire instead of hair) is often requisite. It would be a good thing if all good ironwork would have a coat of redlead when fresh from the fire, so as to prevent rust at the very outset. Paraffin oll, well brushed on, is an excellent cleanser, not only removing superfluous paint, but also removing any rust which might remain in crevices and crannles. A coat of hot boiled oil, as a first preparation, will effectually ensure a good foundation for the after-coats, and will serve to dry up any moisture or dampness, so that no rust may creep in underneath the paint. For inside work a coat of hot oil would be sufficient as a priming on well-cleansed iron. When articles have been scaled by the action of acid, vitriol, etc., it is very necessary to wash the acid away and dry well before painting.

Scratching Shed for Chicks.—With artificial incubation, or when employing incubator chicks, it is essential that a foster-mother be used. Now with only one foster-mother, and with chicks coming out every three weeks from the incubator, the three-weeks-old brood has to be turned out so that the new arrivals can be accommodated; elso with old fowls in the same run as chicks, the latter often get permanently injured, if not killed outright, in the rush at meal times. The scratchingshed here described and illustrated in Figs. 1 and 2 will then be found useful. In its construction the best and cheapest material is 7-in. by ½-in. rough boarding. Cut

about and pick up and scratch for insects. It can also be moved to a fresh spot every day if on grass, which is almost necessary, and it is perfectly safe from vermin, for, as a rule, rats only trouble chickens at night, and this shed could easily be placed on a length of wire netting at night, after the chicks have retired. If no grass is available, the run can be filled with 3 in. or 4 in. of ashes, road sweepings, or anything dry, or even with a good thickness of chaff or chopped straw. Finally, the question of painting, tarring, or limewashing the scratching-shed can be left to the requirements of circumstances.

Plenum and Vacuum Systems of Ventilation.—
Mechanical ventilation is of two kinds, one being the
plenum and the other the vacuum or exhaust principle.
The air is kept in motion by fans, blowers, or fires, or
a combination of these. In plenum ventilation the propulsive force is applied to the incoming air and the
apartment filled, hence the name, which is a Latin word
meaning full. Outlets are provided at convenient places,
and the foul air is driven out by the air forced in. The
advantages of this method are its certainty and the
ease with which the amount thrown in can be altered.
The stream of air can be taken from any point, and can,
if necessary, be washed by passing through a thin film
of water, or filtered through a thin screen of moistened
cotton, and can be warmed or cooled at pleasure. The
disadvantages are the cost, the danger of the engine
breaking down, and some difficulties in distribution.
If the air enters through small openings at high velocity,
it will make its way to the outlets without mixing. The
method requires, therefore, great attention in detail.



Scratching Shed for Chicks.

two posts each 1 ft. 9 in. long by 1½ in., and two posts each 1 it. 6 in. long by 1½ in., each 5 ft. long, and nail one length to the two longer posts to form the bottom of the front. Now run a saw down another length, thus making two pleces, one 4 in. wide and one 3 in. wide and nail the 3-in. width to the other end of the longest posts to form the top of the front. Then nail the remaining two lengths to the two shortest posts, and the 4-in. length as well, making 1 ft. 6 in. in all, and completing the back. Cut off six pieces of board for the two ends each 1 ft. 9 in. long, and nail them to the posts, cutting the top pieces diagonally between the front and back. A partition must now be prepared for cutting off the sleeping compartment, and this can be made of 1-ft. 8-in. lengths, a couple of battens being nailed on the inside to keep them together, and also to nail the front and back to. Fill up the front of the sleeping compartment, when it will be ready for flooring. Nail a ledge across the front and back 2 in. from the bottom edge to carry the floor, and cut off sufficient board for it, making it a loose fit so that it may quite readily be taken out and scrubbed. An exit should be cut about 8 in. high and 6 in. wide, and rounding at the top (see Fig. 2), and a runner should he placed on each side, so that a door may he slipped down at night to keep the chicks warm. A piece of wire netting, I ft. wide and of 1-in. mesh, should now be fastened with staples securely over the engits together with battens to form the door over the sleeping compartment, three more to form the door over the sleeping compartment, three more to form the door over the sleeping compartment, three more to form the door over the sleeping compartment, three more to form the door over the sleeping compartment, three more to form the door over the sleeping compartment, three more to form the door over the lengths together with battens to form the door over the sleeping compartment, three more to form the door over the sleeping compartment

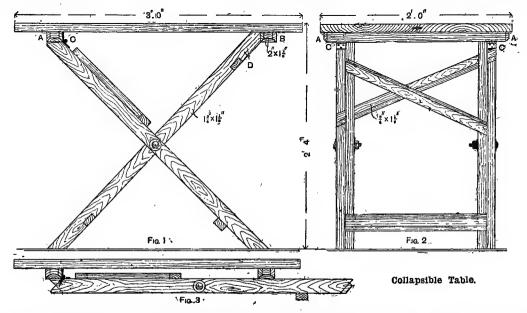
The exhaust, or extraction, or vacuum principle is the converse of the plenum. The propulsive force is applied to the outgoing air. This may be done in several weys. Thus a fan may be used; but in euch case there are the disadvantages of expense and of probable breakdown of engine. A steam jet may be used; this also is expensive, and unless great care is taken it is noisy. A fire at the foot of a tower may be adopted, but here again the cost of maintaining the fire has to be met, as well as other disadvantages. (a) Thore is the inequality of the draught, as it is almost impossible to keep the fire at a constant height; (b) the inequality of movement from different rooms—the hearer ones will have the air changed several times in an hour, those at a distance may hardly feel the influence; (c) if the shaft is large, there may be no movement in the air of the rooms, but a down and up current circulating in the shaft itself; (d) the possibility of reflux of smoke from the shaft to the rooms; (e) the impossibility of properly controlling the places where fresh air enters—the will flow in from all sides, and possibly from places where it is impure, as from water-closets, etc. Air is so mobile that, with every care, it is difficult to bring it under complete control—it will always press in and out at the point of least resistance. For these reasons it will be seen that the plenum system is more likely to be a success than the exhaust system in all cases where natural ventilation is found to be inadequate.

Regulating Speed of Petrol Motor.—The speed of a petrol motor may be regulated in either of two ways, or by a combination of the two. In the first place, the amount of the gaseous charge admitted to the cylinder may be reduced by "throttling" it, and the force of the explosion thereby diminished; or the ignition of the charge may be delayed until later in the power stroke, and the force of the impulse thus decreased. Sometimes the speed-controlling mechanism may accomplish both of these actions, throttling the charge and shifting the spark simultaneously. Unfortunately, the work done by the engine decreases very rapidly with the decrease of speed.

Proportion of Sand to Lime for Various Mortars.—
To make a good non-hydraulic lime mortar, mix 1 measure of pure lime with 3 measures of sand; or, in place of 5 measures of sand, 2 of sand and 1 of blacksmith's ashes or coarsely ground coke. To make a good hair mortar: To 1 measure of unstaked lime add 2 measures of sharp freshwater sand; to every bushel of the unslaked lime add 1 lb. weight of well dried and beaten bullock's hair. In making Portland cement mortar, add 2 parts sand to every 1 of cement above water, the proportion being 1 to 1 when required for submerged work. To make a good hydraulic lime mortar, mix 1 part hydraulic lime with 2 parts of sand; or 1 part of Lias lime with 2'5 parts of burnt clay; these should be ground together. One part of Lias lime and 6 parts of sand is another mixture giving good results. Roman cement mortar has 1 part of the cement to 1 part or 12 parts of sand. Lime is much improved if Portland cement is added thereto, and well mixed with it. The external wall of the Albert Hall was built with a mixture of 1 part Portland cement with 1 part of grey lime and 6 parts of clean pit sand. In making this mixture it is necessary for the lime to be thoroughly slaked for a period of from twenty to twenty-four hours before it

ground generally requires two coats to cover well. Birdseye Maple.—Mix to a paste with linseed oil, 4 lb. of white-lead. Then grind on the palette board rather less than ½ oz. of vermilion. When the vermilion is well mixed or rubbed up with linseed oil—only enough to form a pale pink of it—use ½ lb. of driers, mix well with linseed oil 2 parts and turpentine 1 part, and put it through a strainer. Satinwood.—White-lead, 7 lb.; middle chrome yellow, 2 oz. Well grind the chrome with linseed oil with palette knife on palette board; well mix with 2 parts oil and 1 part turpentine, and strain well.

Angle or Pitch of Smoothing-plane Cutters—
The pitch or angle at which the cutter of a smoothingplane is set is of importance. There are three angles
involved in this case: (1) The angle between the cutter
and the surface of the work. This should be as small
an angle as possible. It is obvious that if the surfaces
of the cutter and the work were perfectly parallel, the
cutter would glide over the surface without cutting,
except under great pressure. By making the cutter
edge rather than its whole surface touch the work, the
tendency to cut and continue the contact is secured.



is mixed with the sand. After slaking, the lime is placed in the mortar mill and the sand added, the mixture being ground for about ten or twelve minutes; the cement is then quickly added, and the whole ground together for a further period of a minute. The resultant mortar has to be used immediately. If it is desired to use hydraulic lime instead of cement in this process, it should be mechanically reduced to fine powder before being added to the mixture in the mill.

Being added to the mixture in the mill.

Graining Grounds.—Buff.—The ground usually made for oak graining is buff, which is made with 7 lb. white-lead, ½ lb. of yellow ochre ground in oil, ½ lb. of driers, mixed with linssed oil 2 parts and turpentine 1 part, and strained when thin enough for use. Knotted oak ground requires generally double the quantity of yellow ochre in oil to the same quantity of white-lead, with about ½ lb. of Venetian red mixed with it. For very dark knotted oak or walnut graining ground, mix 3 lb. of white-lead, 1½ lb. of yellow ochre, ½ lb. of burnt umber, and ½ lb. venetian red in oil. As in other grounds, add ½ lb. driers, well mix and strain. Use 2 parts linseed oil and 1 part turpentlne for mixing. Mahogany.—Take 3 lb. of Venetian red in oil, ½ lb. of orange chrome. Grind up the chrome with a palette knite on a palette board, put in the Venetian red which is a thick paste, and then, after well mixing and grinding up the chrome, put that in. Then pour in about 1 gill of gold size or terebine driers, mixed with boiled oil 2 parts, turpentine 1 part, and put through a strainer. Rosewood.—Chinese red, 2 lb., or vermillonette, 2 lb.; or vermillonette, 2

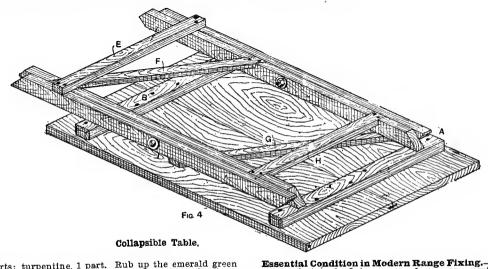
The angle, which may be called the olearance angle, or the back angle, should only be enough to secure this condition of contact. (2) The angle of the cutter itself. The more acute this angle the better, if ouly the material will stand the strain and face the work without losing its edge. (3) The front or remaining angle may be found by subtracting both (1) and (2) from 180°, if dealing with plane surfaces, and is available for the passing away of the waste material; in the case of the plane, however, this is limited in order to provide means to prevent the shaving heing torn up in advance of the cutting action. This provision is made by the front portion of the plane, and to be efficacious must be in contact with the work and as near the edge of cutter as possible to allow waste to escape. A few experiments with a knife will show that for soft materials a slight angle is best. This involves a thin knife, and its side almost in contact with the material to be cut; but as harder things are tried, the stiffness of the cutter, and the consequent angle, must be increased, not because it is merely desirable, but because it is absolutely necessary to have a stronger cutter. Every increase in angle tends to convert the cutter into a scraper. Experience teaches that the more upright pitch is better for harder woods.

Collapsible Table. — Figs. 1 and 2 are elevations of a collapsible table, the height, breadth, and length of which are all dimensioned, and also the sizes of the several parts. The following are the leading points in the making: The top may be 1 in thick, and, to make a strong job, should be formed of two or three boards, which should be ploughed, tongued, and glued together, two ledges A and B (Figs. 1, 2, and 4) heing fixed under-

neath by 13-in. screws. The pairs of legs of the trestles are connected by horizontal rails and braces, which are secured by sorews and glue, so that the inner pair of legs shall fold into the same plane as the outer legs. The rail E (Fig. 4) and the brace G must not be let in, whereas the rail H and brace F can be let by their thickness into the legs. These are connected by bolts with nuts and washers. The outer pair of legs are secured to the ledge A by a pair of back-flap hinges c (Figs. 1 and 2). It should be noticed that a little opening must be left at the upper end of these legs so that raising the end of the table at B releases the top of the leg D (Fig. 1), and thus allows the legs to collapse and the whole table to fold together as shown at Fig. 5.

Marbling Grounds.—Sienna Marble.—White ground. White-lead, driers—2 parts linseed oil and 1 part turpentine. Use thin and strain well. Rouge Royal.—Grey ground. White-lead, 4 lb.; blue-black, ½ oz., well rubbed up on palette in oil; ultramarine blue, about a salt-spoonful, rubbed up on palette. Strain well and use-thin. Egyptian Green (verte antique).—Black and gold, and onyx marbles. Black ground. Vegetable black, ½ lb.; driers, ½ lb. Mix well with boiled oil, 2 parts; turpentine, 1 part. Irish Green Marble.—White-lead, 2 lb.; emerald green, 1 oz.: driers, ½ lb.; linseed oil,

stuff," and causes the coat to set quicker and harder; but it cannot be used for external work, owing to its solubility and rapid destruction when exposed to the weather. There are three qualities of plaster-of-Paris in the market—" superfine" and "fine," sold in casks of 2 cwt.; and "coarse," sold in sacks or bags from 7 lb. upwards. Weight per strike bushel = 64 lb. weight per cubic foot = 50 lb. The gypsum occurs as selenite in the London clay at Lewisham and elsewhere, and particularly near Paris, in transparent white crystals 4 in. or 5 in. long, 2 in. or 3 in. broad, and 1 in. to 2 in. thick, in irregular masses which break up into cubical pieces. When the gypsum is a translucent or nearly opaque white, it is known as alabaster, and is used chiefly for statuettes and ornaments. When coloured in mixed yellow and brownish shades, it is familiar as Derbyshire spar, used also for vases and ornaments. Plaster-of-Paris forms the basis of Keene's cement, which is plaster-of-Paris and alum; Parian cement, which is plaster-of-Paris and borax; Soagliola and Marezzo marble. It is the essential element in selenitic mortar, or Scott's cement, where the addition of 5 or 6 per cent. of plaster-of-Paris to a feebly hydraulic lime checks the slaking and expedites the setting, permitting also a larger quantity of sand to be used without weakening the mortar.



2 parts; turpentine, 1 part. Rub up the emerald green on palette; well mix and strain; use thin. St. Ann's Marble and Grey Grante.—White-lead, 2 lb.; blue-black, 1 oz., rubbed up on palette; also ultramarine blue, 1 oz., similarly rubbed; linseed oil and turpentine in equal parts, driers, ½ lb. To be well strained and used thin. The ground for grey granite is the same as that for St. Ann's marble. Red Grante.—White-lead, 2 lb.; Venetian red in oil, 2 oz.; light vermilionette, I oz.; to be well rubbed up and mixed with linseed oil and turpentine, equal parts; ½ lb. of driers. To be strained and used thin. Livard Marble.—Middle purple brown, 2 lb.; uprits; turpentine, 1 part. To be strained and used thin. White Marble and Florentine Grounds are prepared in the same way as that immediately preceding, but are not quite so grey. Lapis-lazuli.—Rub well on a palette; blued oil, 2 parts; turpentine, 1 part. Brocatello.—White, tinted with yellow ochre in oil, mixed with linseed oil and turpentine in equal parts.

Plaster-of-Paris and its Uses.—Plaster-of-Paris is

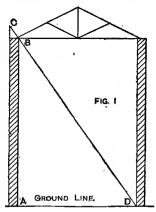
Plaster-of-Paris and its Uses.—Plaster-of-Paris is obtained by grinding gypsum (a soft stone of crystalline texture consisting of hydrated sulphate of lime), and then calcining it in fron vessels until nearly all the water of combination is driven off. It is then in the form of a fine powder like wheat flour in appearance, but heavier. It is used alone or as an addition to other materials. When mixed with water, it sets very rapidly, and attains its full strength in an hour or two. It expands in setting, and is used chiefly for cheap statuary for internal decoration, cornices, centrepieces, and other ceiling ornaments, console brackets, etc., being made into a paste, and incred into gutta-percha moulds. It is also used for filling up holes in walls and ceilings, or other defects, and sometimes in pattern-making for foundry purposes. When mixed with lime for plastering in the proportion of 1 to 4 or 5, it forms "gauged"

Essential Condition in Modern Range Fixing.—The essential feature in fixing any modern range, portable or brick-set, is to make the work sound everywhere, so that ail the air that enters the chimney comes first through the fire. This ensures, in the first place, that the draught in the chimney, is wholly composed of heated air and gases, and this provision secures the greatest possible degree of efficiency. Anything tending to cool a chimney—as the passage of cold air into it, for instance—prejudices efficiency in proportion to the cooling influence that it exercises. In the second place, the passage through the fire of the whole of the air that finds its way into the chimney not only enables the fire to burn its brightest, but forces the flames round the ovens in a most effective style. The fire burns clearer, less soot is formed, and the primary object of the range—cooking—is performed with ease; yet by a simple movement of the damper, or dampers, it can be checked and controlled instantly and perfectly. In a word, in fitting any and every kind of close-fire range, the main and essential condition is that the whole of the air seeking egress by the chimney should be compelled to pass first through the fire. The degree in which this object is attained will be the measure of success or of fallure in the simple operation of fixing portable stoves or ranges.

Allowance for Expansion and Contraction of Iron Roof. — Such allowance is not usual in a roof of 50 ft. span; it must be remembered that the extreme range of movement between summer and winter temperatures is about $\sqrt{l_T}$ in. in 100 ft. In the case of a straight rigid structure like a girder, the ends of which had been securely fixed during one extreme of the temperature, the girder would, during the opposite extreme of temperature, undergo a stress of about 5 tons per square inch in the endeavour to overcome the resistance; but a roof truss can, on a rise of temperature, rise in the centre, and so relieve itself.

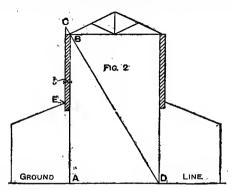
Remagnetising Compass Needle.—A well-known manner of remagnetising a compass needla is by holding one-half of the needle, say the south half, flat on a hard smooth surface of wood, and drawing over it with gentle pressure the north pole of a magnet from the centre to the end of the needle, say a dozen times or more, according to the strength of the magnet and the size of the needle. In order to avoid destroying the magnetising effect produced in the needle by the contact of the magnet, the latter must be moved away in a direct line, say 12 in. from the needle, and returned to the centre by making it describe a circle of at least as great a diameter. By so doing, the magnetifield of the magnet during the return to the centre of the needle will not disturb the molecular arrangement sought to be produced in the needle. The needle is now turned end for end, and the north half is treated in the same manner with the south pole of the magnet. After balancing by sliding into position the little coil of fine wire on the south end of the needle, the latter is ready for use.

Determining Thickness of Walls.—Fig. 1 gives a simple method of determining the thickness of walls. To the diagonal D B of the surface of the wall add D C, a distance equal to one-twelfth the height of the wall. From c drop a perpendicular to the ground line, and this will give the thickness of the wall. This is the rula for dwelling-houses. For a warehouse wall take one-



with hog-hair overgrainer. When dry, varnish with 2 parts varnish and I part turpentine to bind the colour. Mix 1 oz. vandyke brown and ½ oz. of dry drop-black, with water, to overgrain, and varnish, when overgrained, with copal or carriage varnish. Birdseye Maple.—Vandyke brown in water, 2 oz.; drop-black, 1 oz., dry. Rub up in water on palette board, and thin out with 2 parts water, 1 part ale. Mahogany.—Vandyke brown, ½ ib.; damp lake, 2 oz. Rub up well together in water, and thin out with half beer and half water. Satinwood.—Vandyke brown, 1 oz.; raw sienna, 2 oz. Mix well together in water, and thin out with ale, 1 part; water, 2 parts.

Detecting Impurities in Coal Gas.—The chief impurities in crude coal gas, for which qualitative tests are required, are ammonia (NH₂), sulphuretted hydrogen (SH₂), and carbon dioxide, commonly known as carbonic acid (CO₂), and their detection is effected as follows: The presence of ammonia is shown by its action on a moistened turmeric paper or a reddened litmus paper. Turmeric papers are prepared by soaking strips of filter or blotting-paper in an alcoholic solution of turmeric, made by digesting powdered turmeric root in the liquid. They are allowed to dry, are cut into strips, and are then ready for use, but must be kept in a dark place. Turmeric papers thus prepared are of a full yellow colour, which changes in the presence of ammonia to a brownish tint, and sometimes to a deep crimson colour, according to the quantity of ammonia present. They should be moistened before use. A more sensitive test for ammonia is that of the reddened litmus



Determining Thickness of Walls.

aighth instead of one-twelfth as the fraction of the height to be added to the diagonal. This diagram is based upon the examination of 250 churches in Italy, Switzerland, and Germany; it gives a method of setting out the thickness of a wall of an ordinary church or building of one storey, without reference to books at all. The rules which have governed the thickness of walls under the Metropolitan Building Act are expressed in the following formula:—

T = H L

T = H L

Where T = thickness to be found

H = height in feet

L = length in feet

N = the constant

D = diagonal of the face of the wall.

The constant N = 22 for dwelling-houses, 20 for warehouses, and 18 for public buildings. The rule given in Fig. 1 is slightly modified in the case of a church with aisles. Fig. 2 shows how the thickness t of the wall is calculated in such a case. Produce the diagonal D B to C, making B C = one-twenty-fourth of the height of the nave B A, adding to the quantity of walling above the roof of the side aigle B E.

Graining Colours.—Light or Middle Oak for Buff

Graining Colours.—Light or Middle Oak for Buff Ground.—Take ½ lb. of raw umber in cil. ½ lb. of Oxford ochre in oil. ½ lb. of putty well rubbed up on palette, ½ lb. of driers. Well mix with half linseed oil and half turpentine—about 1 pt. would be required. Strain well. It should be rubbed in very sparingly on the work Dark Oak and Knotted Oak.—Mix ½ lb. of burnt umber with ½ gill gold size, or ½ gill terebine. Thin it with 3 parts of boiled oil and 1 part turpentine. Strain well. Walnut.—Burnt sienna, 1 oz. in water; vandyke brown, 2 oz. Rub both together on palette, then mottle in for underneath groundwork. Next mix 1 oz. of vandyke brown and ½ oz. of drop-black dry, together with water on palette, and thin out with porter or ale, and figure

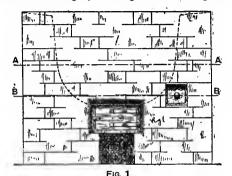
paper (glazed), which turns blue in the presence of the impurity. Sulphuretted hydrogen is detected by causing a current of gas to play upon a piece of writing-paper previously dipped in a solution of acetate of lead or nitrate of silver. The presence of sulphuretted hydrogen is shown by the paper changing to a brownish black colour, due to the formation of lead or silver sulphide, according to the reagent employed. Carbonic acid is detected by causing a current of gas to bubble into lime of baryta water, a white precipitate of calcium or barium carbonate being formed if CO2 is present in the gas. Lime water is the solution most commonly employed, and is prepared for use by placing about 4 cz. of caustic lime in a quart bottle, filling up with distilled water, so as to dissolve the lime, and shaking the bottle occasionally, so as to assist the operation. When the water has taken up as much of the lime as it is capable of dissolving, the excess of lime is allowed to settle, and the clear liquid is transferred to another bottle, which muet always be kept tightly corked, so as to prevent the access of CO2 from the atmosphere. In order to make a test, about 1 cz. of the lime water is placed in a test tube or small bottle, and the gas bubbled slowly through it by means of a glass tube having a very fine opening, this latter tube being connected to the gas supply by a piece of indiarubber tubing. In practice, if a precipitate does not form within the space of three minutes, if is assumed that the gas is tree from CO2. If sulphuretted hydrogen is also present in the gas being tested, it will be necessary to interpose a small oxide purifier, so as to prevent any sulphuretted hydrogen entering the lime water, since the presence of the latter gas would vitiate the test.

Adding Chapes to Harness Head Collar Squares.—

Adding Chapes to Harness Head Collar Squares.— To put chapes on head collar squares, open the parts where the chapes are to be, and run them between the leathers, first thinning the ends a little, and making a strong cross stitch near the ends.

Manufacture of Prussian Blue.—There are several methods of manufacturing Prussian blue, the following being a common one: A solution of copperas (ferrous sulphate, FeSO) is made with cold water in a tub; in another tub is prepared a solution of yellow prussiate (potassium ferrocyanide, K₄Fe(CN)₆), the two colutions are then run into the precipitating tub, when a bluishwhite precipitate of potassium ferrous ferrocyanide (K₄Fe₄(CN)₁₂) immediately separates. The clear liquid is drained off, and the precipitate washed as rapidly as possible with several changes of water. The precipitate is atterwards treated with a solution of bleaching powder (calcium hypochlorite CaOCl₂) and hydrochloric acid (HCl), whereby it is oxidised to ferric ferrocyanide, or Prussian blue (Fe₇(CN)₁₆). After again washing the precipitate with several changes of water, it is filter pressed, and dried in the dark at a temperature of about 130° F.

Principal Defects in Timber.—Heart shakes are cracks starting from the centre and going towards the bark. If they twist in the length they are very objectionable, as they cannot be cut out. They are called star shakes when several are grouped at the centre. Twisted fibres, from the prevalent winds turning all the branches in one direction, although they start from different points in the circumference of the tree. Oak with twisted fibres will not retain its shape when squared, but is very suitable for splitting up into plugs for bricklayers' and masons' use. Cup shakes are separations between the annual rings. Thunder shakes are irregular fractures across the grain, occurring chiefly in Honduras mahogany. Rind galls are swellings caused



Setting Washing Copper.

by a growth over a wound, generally where a branch has been lopped off. Loose, large, or dead knots are defects of growth. Dantzic timber has the largest knots, spruce the hardest. Wanes are rounded angles produced by endeavouring to square a log to a larger size than the tree will hold throughout; such timber is called waney. Other defects arise through careless or improper seasoning—as twisting, warping, winding, wind-cracks, and shakes. Dostiness is a defect produced by imperfect seasoning or by exposure for a long period to a stagnant atmosphere. It appears as spots or a speckled stain on the timber, particularly beech, birch, and American oak, and is a symptom of incipient decay. This is probably the same as the general foxiness produced on the surface of American white pine used by pattern-makers and for panelling. Dry to is promoted by insufficient seasoning, or use in a moist, warm, confined atmosphere; want of ventilation is the most frequent cause. Unless timber is creosoted, sapwood at the edges of the planks or corners of the logs is a very serious defect, as this part will decay soonest.

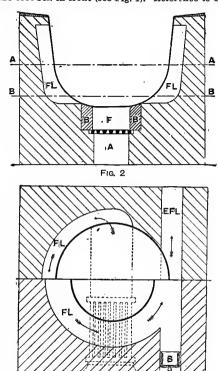
Setting Washing Corner—The sless here specified

Setting Washing Copper.—The sizes here specified are for a pan of 60-gal, capacity. As, however, the same method of construction applies, whatever size may be used, the measurements only need varying according the job in hand. The average clear diameter at top of galvanised pans of various capacities is as follows:—

Contents in gallons: 6 8 10 12 18 20 25 30 40 50 Diameter in inches: 15 17 18 19 22 23 241 261 29 301

An apparatus of 60-gal, capacity will require a pan about 32-in. diameter. The casing here specified may be taken as the minimum amount it is advisable to provide, and, therefore, if the copper is to be an isolated structure, another 4½ in. may be added to its skin, which will materially assist in conserving heat. In square form it is handiest and also easiest to huild; but, should it stand in a corner, it may be advisable to

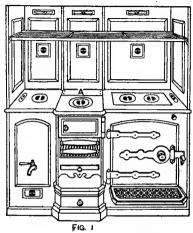
cant or round the front. The necessary metal-work required in addition to the pan consists of farnace door and frame, furnace grating, soot-box, and damper. Site having been selected and foundation of some sort provided, lay the pan down bottom upwards in the position it is to occupy. Mark its position, allow \$\frac{3}{2}\$ in. beyond its circumference for fine, and \$\frac{9}{2}\$ in. beyond the pan for the ontside of brickwork. Set out the ashpit according to the length of the furnace grating, allowing for the furnace door heing set back \$\frac{3}{2}\$ in. or \$\frac{4}{2}\$ in. from the face of the brickwork. Build up solid for three courses, forming the ashpit as the bricklaying proceeds. The mortar should be good, and, preferably, gauged with Portland cement. Bed the furnace grating, and place the door and frame in position; then form the bottom and sides of the furnace with firebricks. Bed the pan immediately on the furnace, and continue the brickwork until within one course of the top of the pan, forming the fines as shown in Figs. 2 and 3, and building in the soot-box in front (see Fig. 1). Reference to Fig. 2



will give, by means of the arrows, the direction of the air-current or draught, and, consequently, when in use, the heat through and around the apparains. It will be observed that on one side of the inrnace at the back (according to "hand"—in this case the right-hand side) the fine is obstructed by a baffle of brickwork built close up to the pan in order to prevent the heat generated in the furnace from passing direct through the escape-flue into the chimney. The heat therefore has to complete the entire circuit of the pan before passing away. For a similar reason the space above the front of the furnace between the pan and brick-casing must also be closed by brickwork or stone, the top surface of which will form the bottom of the fines, and on a level with which the soct-box is to be fixed. With the last course of bricks cover over the fine, and finish off the top with cement and sand, dished towards the pan, and floated to a smooth surface. In some parts of the country it is customary to finish off the top with a elate or stone slab, but the former method is the cheaper, and, if nicely done, makes a good job. The position of the existing chimney (if intended to be utilised for turning the copper flue into) will determine the "hand" to which the copper has to be built, and consequently the position of baffle and outlet-flue. Only this latter now remains to be built, in which the damper for regulating the draught through the furnace is to be fixed, when a lid of wood, in the construction of which no iron screws or nails must be used, will complete the job. or nails must be used, will complete the job.

Fig. 3

Painting Ironwork.—When rusted iron is coated with oil paint, it for a time appears as if the rusting process had ceased; but this is by no means the case. Chemical action is set up, forming a monoxide of iron, which has a greater affinity for oleic acid than any other known compound. This unites with the oil-acid in the paint, and thus forms a conductor that enables damp to enter. The corrosion is carried on underneath the paint, which eventually peels off, when the surface underneath is found to be much further rusted than when first the paint was applied. What is wanted for the protection of iron is an elastic paint which will not convey damp or give up oxygen to the iron. The pigments which not only possess these qualities, but are also really decorative, are fewer for iron than for any other surface. The pigments usually employed for the painting of ironwork, stated in the order of their relative permanence, are: Red-lead, litharge, vermillon, and the oxides of iron. Other colours, sometimes used alone, sometimes mixed, are white-lead and zinc-white, together with other pigments. The elasticity of these paints depends upon the vehicle with which they are mixed. Their endurance depends partly upon their natural constitution, and partly upon interaction with similar substances. The first-mentioned of these pigments, red-lead, affords by far the best priming for ironwork. When mixed with the requisite quantity of good oil, it chemically hardens, forming a lead soap insoluble in water. Red-lead, mixed with two-year-old cold-pressed linseed oil, applied directly it has been



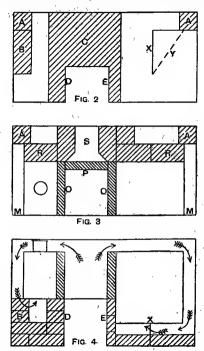
Setting Close-fire Kitchener.

mixed with the oil, before saponification sets in (which process rapidly takes place when the oil and lead are mixed together), will preserve iron from rust for many years. It clings to the iron so firmly that when the iron requires repainting there is no need to scrape off the old coating. It does not scale, blister, or powder, will make a first-class aquatic cement when mixed with glycerine, and is an excellent paint for railings, bridges, or glass houses. When red-lead is used as a finishing colour as well as a priming, a range of tones may be obtained by the addition of the various oxides of iron. A good tone of chocolate may be made with the help of oxide of manganese. Litharge stands next for its power of endurance, and behaves in much the same way as red-lead. Neither red-lead nor litharge requires driers. Another cheap pigment for application in painting ironwork exists in Turkey umber, which, however, has its drawbacks. When mixed with linseed oil it requires driers. If used with boiled linseed oil it gets too hard, cracking and peeling off. To counteract this tendency, and to give elasticity, a little raw linseed oil should always be added, in the proportion of one-third raw to two-thirds hoiled oil.

Setting Close-fire Kitcheners.—In fixing a simple

Setting Close-fire Kitcheners.—In fixing a simple pattern of kitchener, with one oven and a side boiler, as shown in elevation in Fig. 1, stand the oven and boiler parts in position, and by means of the fire-bar frame, temporarily connect the oven and boiler fronts together. Stretch a straightedge from one jamb to the other, and make the front of the range fit the straightedge. If the top plates are not in position, put them right and fit the small plate A. Try in the screws to see if they work; then if the top plates are level, as tested by the straightedge, the brickwork can be pro-

ceeded with. In the first place, measure the distance from the floor to the under side of the oven. If it is no more than 6 in, bed a course of bricks flat over the entire space to be covered by the oven, thus leaving a space of 3 in. for the flue. If the distance is more than 6 in., the brickwork must be raised in proportion, so as to keep a 3-in. flue. Should the brickwork rise above the soot-door, it must be bevelled down, so that the soot can be easily raked out. In Fig. 2, which is a plan of the bottom at the level of the flues, x is an iron baffle plate fixed to the bottom of the oven in order to prevent the flame ascending the back flue before spreading round the bottom of the oven. Should there be no baffle-plate, an alternative plan is to set a thin brick, or to get some small paving tiles, 6 in. by 6 in. by 1 in., and stand them on edge in the position shown by the dotted lines at y, bringing them to within 7 in. of the front and in the centre of the soot-door, so that the brush and the rake can work on each side. Set the tiles first and build the bricks round them, then the tiles will not get knocked away when the flues are being cleared. Build the "stops" as shown at 4, so as to expose as much as possible the backs of oven and boiler. Build up as shown at B and C, and place the ashpan in position



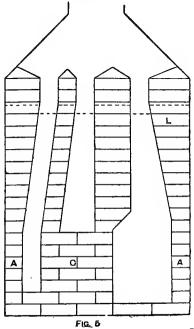
to set the bricks to. It will be noticed that the work is wider at D than at E. By that arrangement a bearing is provided for the boiler (see Fig. 4). This plan is not always possible, as in some cases it would leave no room for the flue of the boiler. The general custom is to build brick on edge all round the ashpan. Should there be a draw-fret as shown, care must be taken to fit it in position, and to leave space for the bars to go in. Lay the bottom grate in position, and also the false bottom, should there be one. Fit in the two fire-tiles, o (Fig. 3), bevel the bottom of the back tile P, so that it will fit against the false bottom and stant back to the ends of the side tiles. Build up the hrickwork to the level of the top of the oven. In most modern ranges there is an iron guard or ience across the back of the oven and boiler at R. In that case it is only necessary to make the top-plate bed solld on to it; but should the guard or fence he omitted, firebricks must be bedded across, the firebricks being placed as shown at s, and the fire flue formed. In the case of an open fire arrangement, bring up the firebricks to the top of the opening. Make sure that the corners M are perfectly airtight. This quality is best ensured by spreading some mortar up the edges of the jambs before standing the parts in position, and then with a double lath, or long chisel, pressing the mortar hack against the front. The work being level with the top of the range, bed some red-lead around the coliar of the boiler, and some mortar on the oricks at R, and serew on the top plates. Spread some

mortar thinly over the brickwork at the back, stand the back coverings temporarily in position, and mark the width and level of the dampers. Then take down the covings, and with a straightedge mark down from the width of dampers to the width of the flues at the top of the range. The brickwork can then be carried up to the first dotted line (Fig. 5), which is the level of the dampers, when mortar must be bedded up the front of the brickwork, and the covings placed in position. Bed on the damper frames, and carry up the brickwork has to be brought over as shown at L, a nail must be occasionally driven into the joints of old work to prevent the new work from pitching over. Fix the covering-in plates in position level with the top of the covings. Place the register, as shown in Fig. 6, as near as possible over centre of fire. Bed a course of bricks round the top of the covering-in plates or slates, and leave all sound. The flame travels in the direction shown by the arrows, over the top, down the sides, round the baffle, under the bottom, and up the back. The principle is

until it will slip over the shaft. When it cools it is in a state of tension, and the shaft inside is compressed, the amount of tension or compression depending upon the difference in the diameters of the two pieces. Great force is required to pull the sleeve off the shaft. Though apparently both sleeve and shaft were brought to a smooth finish where they were to fit together, on careful examination with a microscope numerous irregularities would be found on those surfaces that are to come together. The irregularities are mostly annular groovings formed by the lathe tools and files. When the sleeve is shrunk on, in cooling the little projections on one piece sink into the depressions in the other, and thus the sleeve is firmly locked on the shaft.

Coating Steel Plates with Tin.—In the early days of tinplate making, the plate (it was of iron then) was merely dipped in a bath of tin and allowed to take up just as much metal as it would. Now, however, the manufacturer must know within 2 oz. how much tin is used per cwt. of plates. The amount of tin varies up

Fig. 6



Setting Kitchener.

much the same whether there are two ovens or one. When the boilers are at the back there is generally a hot-water supply to baths, etc. In the arch-flue boiler the fire goes under the bottom and up the back. In those without an arch the fire generally goes over the top; but some are set on firebricks to make a flue underneath.

Rare Atmospheric Gases.—The known five rare gases in the atmosphere are estimated to have the following relative proportions: 0.937 part of argon per 100, 1 or 2 parts of neon per 100,000, 1 or 2 parts of helium per 1,000,000, about 1 part of kryptom per 1,000,000, and about 1 part of xenon in 20,000,000. The function of these inert gases in the atmosphere is unknown. Oxygen is the life-sustainer for everything on the earth; nitrogen restrains the activity of oxygen within proper bounds; carbon dioxide, ammonia, nitric and nitrous acid are necessary for the growth of plants; vapour of water plays a great part in deciding the weather, and even ozone contributes its share of usefulness in frecing the atmosphere from the deleterious matters; but argon and its companions in air apparently are of no benefit to the living world.

Forced and Shrink Fits in Machinery.—Once it was the custom to taper the holes and shafts in forced fits, but it is now conceded to be much better to have them perfectly cylindrical throughout. For shrinking a sleeve or ring of metal on to a shaft or tube, the hole is bored a trifle smaller than the diameter of the shaft to go in it. It in per it. of diameter of ehaft being a common practice. The sleeve is expanded by heating

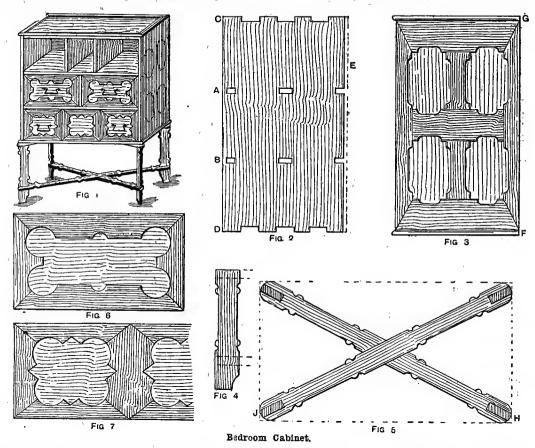
to about 10 lb. per cwt. of plates. The tinning set consists in its simplest form of a tin pot or iron bath filled with molten tin, and a grease pot filled with palm oil and containing a tinning machine. This machine is an arrangement of steel rolls about 4 in. in diameter, revolving in an iron frame, and its function is to squeeze from the plate all superfluous tin. The speed at which the rollers revolve can be varied within certain limits, and the pressure exerted between the rolls is capable of adjustment by means of springs and screws, so that the amount of tin left on the plate can be regulated with considerable accuracy. The steel sheet is dipped into the molten tin, through a flux of chloride of zinc, and from the bath of tin it passes up through the rolls of the tinning machine which is working in the grease pot. There it passes to a rack, where the tin sets for a moment; traces of oil are removed by rubbing with fine bran, and when the plate is dusted it is ready for the assorting room, where the plates are sorted into waste and waste-waste and perfect plates.

Magnolia Metal for Bearings.— Magnolia anti-

Magnolia Metal for Bearings. — Magnolia antifriction metal is an excellent lining metal for bearings, and has a melting point of 450° F. The thickness of the lining varies from § in. to 1 in., according to the length and diameter.

Blacklead for Insulating Armature Stampings.— Blacklead is a sufficiently bad conductor. It is cheap, easily applied, and gives 4 per cent. increase in the quantity of iron that can be packed in any volume compared with paper insulation. Bedroom Cabinet.—The small bedroom cabinet illustrated by Fig. 1 has spaces for books and articles of a miscellaneous character. It is only 3 ft. 6½ in. high, 2 ft. 7½ in. wide, and projecting only 1 ft. 4 in., and a light wood should be used, to be merely polished or varnished. The principal pieces—namely, the ends, top, bottom, and horizontal partitions—are of ½-in. wood planed down to about § in. The side pieces (Fig. 2) are 2 ft. 3 in. high by 1 ft. 3 in. wide. The mortises A are for the tenons of the upper horizontal partition, and mortises B are for the lower partition, whilst openings at c and D are cut for rough dovetaining with the top and bottom. All these are so arranged as to be hidden by appliqué ornament. The dotted line E shows the line of the back board, the ends of which will also be hidden in the same manner. The top, bottom, and horizontal partitions are 2 ft. 6 in. by 1 ft. 3 in., their ends being cut to fit the openings in the sides. The tenons of the partitions must be glued into

above. At the front and sides they overhang by ½ in., but the hind strip comes flush with the back board. These are also mitred at the corners. The stand is fastened to the cabinet, and is 1 ft. 3 in. high. The legs (see Fig. 4) are of 1-in. wood, 3 in. wide, and are connected by two pairs of diagonal braces. These braces are also of 1-in. wood, but are 2½ in. wide only by 2 ft. 11 in. Where they intersect in the centre they are of course halved and screwed together, and in the ends of each is a cut, 3 in. by 1 in., to receive the leg, which is fixed with screws. The lower pair (Fig. 5) are ornamentally shaped, and are fixed 3 in. above the floor line; the upper pair, which are otherwise similar, are left plain, and come flush with the tops of the legs. These tops are strongly screwed to the bottom of the cabinet. The three drawers are roughly dovetailed together, anything unsightly on their fronts being hidden by the applique work, to allow space for which they should be made 1 ft. 23 in. deep only; they will then when



their mortises, whilst the top and bottom will be fixed with screws. The three upright partitions are fixed with dowels above and are screwed below. The back board is of ½-in. stuff, and measures 2 ft. 6 in. by 2ft. 5 in.; it is simply screwed to the top, bottom, sides, and partitions. Fig. 5 shows the side when covered with the appliqué work. The pieces are cut from ½-in. board, and will best be fixed with quite small round-headed screws arranged in an orderly manner. The long screws at the back and front should have their outer edges neatly rounded off. A strip F of ½-in. board, ½ in. wide, runs over the appliqué work, and is screwed through it into the side pieces, with the bottoms of which it comes flush. This and its fellow of the opposite side are met at the corners by a third similar strip, which runs along and is screwed to the front edge of the bottom. The corners are, of course, mitred. Another strip a with its fellows forms a cornice round the top of the cabinet. These top strips are four in number, and are ½ in. by 1½ in. They lie on the cabinet top, and are screwed down to it, thereby hiding the dovetalling of the sides, which would otherwise be seen from

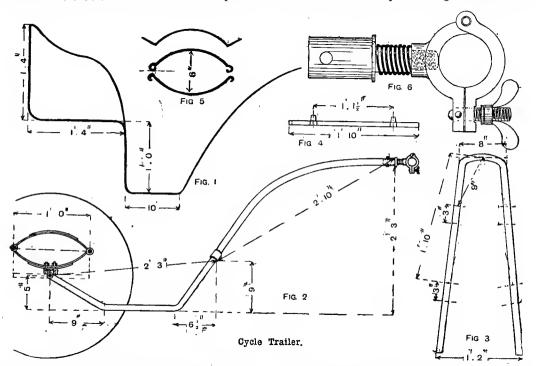
finished come flush with the sides, partitions, etc. Fig. 6 shows the design of the applique work on a larger scale on one of the upper drawers, and Fig. 7 is part of the front of the lower drawer. Such of the screws used in this cabinet as appear in eight, with the exception of those which fasten down the top strips, should be round-headed, and should be placed regularly so as to be ornamental.

Advantage of Lead-burning over Soldering.—The advantage of lead burning over soldering is that only one metal is used, and corrosion hy electrolysis, or voltatic action, does not take place as when another metal, such as tin in solder, is in contact in a wet position. The only circumstance in plumbers' work in which burning must be insisted upon are in chemical works or manufactories where chemical acids are used. The pipes, tanks, acid chambers, etc., have to be made of lead, which should be as pure as possible, free from alloys of other metals (excepting when hardened by antimony for special purposes, such as acid pumps), and joined together without the aid of solders.

Cycle Trailer.—The basket of a cycle trailer should be built of strong wicker, as shown in mere outline by Fig. 1. It is optional whether the basket is carried up the connecting tube or only to the top of the body, although the former method adds greatly to the appearance of the ear. The frame and connecting tube is made of 1-in. by No. 16 gauge steel tube, and the axle from f-in. by No. 16 gauge steel tube. They should be packed tightly with fine casting sand, and heated to a duil red colour for bending. For the body, one side of which is shown in Fig. 2, the length of tube is 6 it. Mark the centre of the tube with a file, and bend it from this centre as shown in Fig. 3. Then mark on each side with chalk at distances of 9 in., 1 ft., 1 ft. 10 in., and 2 ft. 1 in. from the centre. The bends will come between these marks. Bend a piece of wire to the required angle, and use it as a template for working the body tubes. The ends of the tube must be at equal distances from the centre mark, and so must the end of the axle (Fig. 4), when this is brazed to them by two f-in. lugs or laps. With some hubs there are two discs, with right- and left-hand threads, * in. in diameter, and these are brazed into the ends of the axle. The hub spindles

of 1-in, wood is placed between the axle and the springs. A staple bolt goes round the axle at each side of the spring, and a plate having four holes to correspond with the ends of the bolts goes over the spring and is screwed down tight to the axle. The top of the spring is fastened to the middle of the basket seat by four bolts, with a plate at the top and bottom. The basket is also fastened at intervals by staple bolts which go round the tube and through the basket with a small plate on the top. The wheels are built up with No. 15 gauge spokes, and are fitted with pneumatic tyres. This car will carry persons of average weight, but for a juvenile car use No. 20 gauge tube, with No. 14 gauge steel for the springs, and 26-in. wheels.

Rendering in Cement.—This is the application of Portland cement to brickwork in one or more coats. It is generally done to improve the appearance or to prevent damp, such as sea spray or rain, from reaching a wall. If the wall is liable to damp, it should be as dry as possible before the cement is put on, or the cement will perish. If the wall absorbs moisture from the soil it is almost impossible to get the cement to



are screwed into the discs, the right-hand thread, inserted in the right-hand end of the axle, standing at the back of the car. For the connecting tube shown brazed to the body in Fig. 2, the length is 3 ft. 4 in., and this tube is usually 2 ft. 3 in. from the bottom of the body, but it should be higher or lower to suit the size of the frame. It is joined to the body by a lap or l-in. right-angle lug, all joints being pegged and brazed. The springs (see Fig. 2) are bent as shown in Fig. 5. The ends of the bottom baif fit into the ends of the top half, and are fastened together by a /k-in. rivet over washers. They are made from 1½-in. No. 10 gange spring steel. A strip of the same steel is riveted at the top and bottom for strength, and this may be longer or shorter to suit the weight to be carried. The clip (Fig. 6) is made in halves riveted together. The forging or casting is § in. by § in. in section, and the ends of the clip are slotted as shown by dotted lines. The pin is riveted at the bottom, so as to swing out of the way, and allow the clip to be opened. A §-in. pin with a head is threaded §-in., and is screwed into the boss on the side of the clip. A coil spring goes over this pin between the boss on the clip and box in which the head of the pin slides. The box fits tightly into the end of the connecting tube, and is secured by A ½-in. bolt. The inside of the clip is lined wfth leather, and goes round the seat pillar, which it fits loosely. The springs are fixed to the axle over the laps. The distance from centre to centre of the spring is 1 ft. 1½ in., and a block

stand. For the first coat the mixture should be 2 of gravel to 1 of cement, and for the finishing coat 1 to 1; too much cement in the mixture makes it technically too rich, and is likely to cause cracks. For mouldings and smooth faces, sharp sand should be substituted for the gravel. The first coat should have set quite hard by the second day; it may then be well watted and the second coat put on. The last coat should not be touched with water, and if rain gets to it before It is quite dry it is liable to perish; on the other hand, fine cracks often arise through the under coat being too dry when the last is put on. For rendering inside parapet walls, cement and sand are used without gravel, the mixture being from 5 sand and 1 cement, to 3 sand and 1 cement.

Lettering an Outside Lamp.—Enamelled iron letters are scarcely suitable for an outside lamp, but could be used if carefully fixed. Both emamelled and opal letters are liable to fall off with the heat from the lamp. For a fixing solution, use white-lead mixed to a workable consistency with a little gold-size. A thin layer of this is applied to the backs of the letters, which are pressed firmly and evenly to the glass; any superfluous coment squeezed out should be removed after about three days. The most satisfactory, also the most durable, method will be to have the name on the lamp sandblasted and painted the colour desired; this, if properly done, will last a considerable time and always look attractive.

Varieties of Oak.—English oak is light brown or brownish yellow, close-grained, tough, more irregular in its growth than other varieties, and heavier. Tenacity, say, 6½ tons per square inch; weight, 55 lb. per cubic foot. Baltic oak, from Dantzic or Riga, is rather darker in colour, close-grained, and compact; weight, 49 lb. per cubic foot. Riga oak has more flower than Dantzic. American or Quebec oak is a reddish brown, with a coarser grain, not so strong or durable as English oak, hut straighter in the grain. Tenacity, 4 tons per square inch; weight, 55 lb. per cubic foot. African oak (so-called) is not an oak at all. Chestnut much resembles oak, but is softer, and the silver grain is not so apparent. Exposed to the weather, oak changes from a light brown or reddish grey to an ashen grey, and becomes striated from the softer parts decaying before the harder. In presence of iron it is blackened by moisture owing to the formation of tannate of iron, or ordinary black ink.

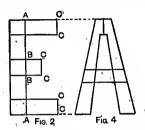
Floral Letters for Decorative Purposes.—As an example of the making of decorative floral letters, the initials E and A will be treated. To make these letters, get some \(\frac{1}{2}\)-in. wire and some fine wire, such as is used with artificial flowers; tissue paper, both plain and crimpled, in different colours, say white, red, piuk, yellow, and two or three shades of green, will also be needed. The tools necessary are a pair of wire-cutting pliers, a small flat file, and a pair of scissors. The wire framework for the letters may be home-made, and for this purpose a small soldering-from will be required. Before beginning to make the first letter E, first decide what size the letters are to be, say 3 ft. by 1 ft. 6 in. for street decoration. Take 6 ft. of the stout wire, and 18 in. from one end bend it at a right angle; do the same at the other end (see Fig. 1). Now out a plece 3 ft. long, and solder it at A A (Fig. 2), the width of the space being 6 in. Cut also two pieces 1 ft. 6 in., two pieces 1 ft. long, and three

involved. The reflection of light and heat from the fused glass is extremely fatiguing to the sight and, in the long run, causes a special disease. Besides, the stay in a superheated atmosphere tends to the formation of tad drinking habits. Again, the blowing of the glass is accompanied with serious inconveniences, especially for bottle makers. The rough turning is very fatiguing, the workman having to give the mass of glass, which is often quite heavy, a rapid rotary motion lasting for nours. Blowing by pipe into the fused glass rapidly involves the burning of the tissues of the throat and cheeks, and soon tends to rupture them. Such work frequently causes pulmonary phthisis, or at least often affects the respiratory tracts. Not the least danger is the transmission of contagious diseases to the workmen by means of the pipe.

American Macadam.—This system of paving consists of a 4-in. course of 2-in. to 2½-in. stone laid on a foundation of concrete made with 1 part cement, 3 parts of rough sand, and 6 parts of small stones. On the top of the stone course is spread a thin bituminous cement to form a bond between the foundation course and the wearing course, the latter being of bitumen and 1-in. to 2-in. stone, with smaller particles to fill the voids, this course being rolled to a finished thickness of 2 in. The stone is heated and mixed in a pug mill with a hituminous cement composed of gravel and asphalt or some other bituminous material, and the mixture is carried to the site in waggons, spread like asphalt, and rolled with a 15- to 20-ton roller.

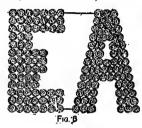
Weight Per Foot Run of Lead Pipe Required by the Water Companies.—The weights vary in different towns. In London they are governed by "The Metropolis Water Act, 1871," which states: No lead pipe shall hereafter be laid or fixed in or about any premises for the conveyance of, or in connection with, the water











Decorative Floral Letters.

pieces 6 in. long. The longest pieces form the upper and lower inside of the letter, the two 1-ft. pieces, placed 6 in. apart across the centre at B, form the centre bar, and the three 6-in. pieces close the ends c of the bar. For the letter A, cut a piece of wire 6 ft. 9 in. long, find the centre, mark off 3 in. at each side of it. and hend down each end from those marks to form Fig. 3. Cut another piece of wire 5 ft. 5 in. long, find the centre of this, mark off 1½ in. from each side, and bend the two ends down as before to form the inner sides of the letter A. Now cut a piece 1 ft. 6 in. long, and another 1 ft. 3½ in. long. Place the longer of these across the letter 1 ft. from the bottom, and the other piece 5 in. higher up, forming the centre of the letter. Now cut wo pieces 6 in. long for the bottoms to complete, with a strengthener at the top, the letter A (Fig. 4). The two letters may be joined at the top and bottom, as shown by dotted lines in Figs. 2 and 4. For the flowers, take a sheet of tissue paper of a suitable colour, fold it lengthways until the last fold is about 4 in. wide, and with a sharp knife separate the folds. Take a strip of this, roll it from one end, one hand pinching up the bottom part, then open out the top with the ther hand, so as to form the shape of Fig. 5. Cut the fine wire into lengths of shout 6 in. each, twist a piece from the centre two or three times round the small part of the rose, leaving the two ends out for twisting round the wire letter. Fig. 6 shows the completed letters with flowers.

Effects of Glassblowing on Health.—Glassware manufacture destroys health in more than one way. Despite the precautions that may be taken, the extremely high temperature of the furnaces (about 2,192° F.) causes a considerable disengagement of heat, this being assisted by the glass in a fused state, which is at a temperature of from 1,292° F. to 1,472° F. The rooms near the furnaces have a temperature varying from 104° F. to 122° F., and whatever be the lightness of their clothing, the workmen are in a constant state of perspiration, and many inconveniences and ailments are

supply by the company (except when and as otherwise authorised by these regulations or by the company), unless the same shall be of equal thickness throughout, and of at least the weight following:—

| Internal Diameter of | Weight of Pipe in Pounds |
|----------------------|--------------------------|
| Pipe in Inches. | per Lineal Yard. |
| a in. | 5 lb. |
| . 3 ,, | 6 ,, |
| ģ ", | 7½ ,, |
| ‡ " | ,9 ,, |
| 1 ,, | 12 ,, 16 |
| 14',, | 10 ,, |
| | |

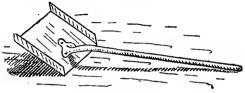
From this it will be seen that the weights per foot are: For ½-in. pipe, 2 lb.; for ¾-in. pipe, 3 lb.; for 1-in. pipe, 4 lb.; for 1½-in. pipe, 5 lb. The weights of the other service pipes are not given in the regulations, but are about as follows: For 1½-in. pipe, 7 lb. per foot; for 2-in. pipe, 10 lb. per foot; for 2-in. pipe, 11 lb. per foot. For overflow or warning pipes the weights are: ½-in. pipe, 1 lb. per foot; ¾-in. pipe, 1 lb. per foot; ¾-in. pipe, 1 lb. per foot; 1-in. pipe, 2 lb. per foot.

Case-hardening Armour Plate.—Two plates are heated together, a layer of charcoal being between them whilst they are quite enveloped with bricks and sand. The whole is placed in a gas furnace or oven and kept at great heat for fitteen days, by the end of which time the surfaces in contact with the charcoal have become carburetted sufficiently. Bending is done directly after case-hardening.

Grease for Hemp Ropes.—To prepare grease for hemp ropes, melt tallow, running it through a sieve into another vessel, and then mix with it, constantly stirring, one-fifth part, by weight, of hot linseed-oil varnish. These ingredients must be incorporated thoroughly; then add one-fifteenth part of vaseline. The preparation is applied whilst lukewarm by means of a wooden spatula, and rubbed in with a clean woollen rag.

Colour Values of Painters' Pigments.—None of the pigments used by the painter are direct central colours suitable to be placed at regular intervals upon the chromatic circle. Vermiliou is a yellow tone of red; Indian red is purple in tone; light red is inclined to yellow, and is neutral in character. The nearest direct yellow is pale chrome. Prussian blue is a greenist tone of blue, and is a good colour for mixing green; ultramarine blue is a red blue, and makes, when mixed with yellow, a low tone of green, on account of the red in the blue, which neutralises the green. Emerald green is a cold strong green; cobalt is nearer to green than ultramarine. The ochres, siennas, and browns are all tertiary tints, and do not come within the scope of the chromatic circle. In none of the pigments is there direct central colour, such as exists in the rays of light.

Concrete Foundations for Roadways.—Undoubtedly the best foundation for roadways is formed of concrete. It is expensive as compared with inferior systems, but in road work the most expensive construction is in many cases the cheapest when maintenance over a long period of years is taken into account. Most of the large cities and towns where the traffic is of a heavy character are making use of this class of foundation. Experimentally, concrete was used in this way many years ago. Mr. G. F. Deacon, at one time city engineer of Liverpool, was, however, one of the first to make use of it on an extensive scale, and has detailed very fully the methods he adopted. The following abridgment of his description will serve to illustrate the construction of such a foundation. The ground on which the foundation has to be laid is well watered; upon it is scattered a layer of wet broken stone like coarse macadam. Upon this is spread a thin layer of Portland cement mortar, and broken stones on top of it. The whole mass is then well beaten with beaters



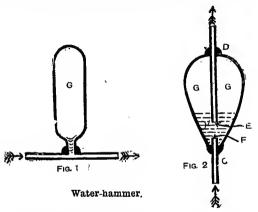
Beater for Concrete.

something like large spades. They are illustrated above, and are made of sheet iron about 12 in. square and in. thick, with straight handles about 4 ft. 6 in. long. After this beating of the mass, another layer of mortar and another of stone are followed by more beating, and so on until the required thickness is attained, when the surface is finished by rubbing with the beaters to the proper curvature of the roadway. The neual thickness of this foundation is 6 in. Before taying the paving setts on this foundation, it should be left untouched for as long a period as cfreumstances will allow—certainly not less than eight days, and preferably three or four weeks. The concrete as at present used in Liverpool is composed of broken stone 8 parts, gravel 6 parts, and Portland cement 1 part, all measured dry and separately. When mixed together the proportion becomes 1 of cement to 11 of broken stone and gravel mixed, as 3 parts of the gravel make their way into the above description, besides being rigid and capable of the armough the heaviest traffic, has the merit of presenting a smooth, even surface for the paviors to lay the setts on, and, being homogeneous, is not liable to give way in spots while remaining good elsewhere. Perhaps the only objection that has been raised against it, irrespective of the question of cost, is that the strength of a concrete foundation when laid in a cambered or arched form will sometimes keep up the road even when the substratum of earth has fallen away from any cause, and that there is a probability of gas from the mains getting into the cavity and blowing up the roadway and the traffic upon it. The chances of such a contingency are so very remote that the objection will in all probability weigh very slightly against this method of forming foundations. In some cases, instead of using cement concrete for the material for the foundation, the latter is made of what has been called bituminous concrete, which is to all intents and purposes the same as tar macadam. Stones broken as for maca

sets quite hard in a few hours, and is impervious to water, thus affording an excellent protection to earths which are easily affected by moisture. Nearly all concrete foundations are 6 in. thick. At Belfast and Huddersfield the thickness sometimes becomes 9 in., while at Ipswich a thickness of 3 in. only is used. The proportions of the ingredients vary from 1 of cement to 4½ of stone and gravel or sand, to 1 of cement to 7 of the other ingredients. Blackburn, Belfast, Newcastle, and Preston still use the Telford or hand-packed foundation in some of the streets. Manchester and Salford adopt a 12-in. foundation of ballast or cinders and gravel.

adopt a 12-in. foundation of ballast or cinders and gravel.

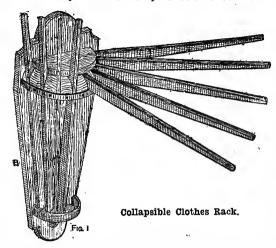
Cause and Cure of Water-hammer.—Water-hammer occurs mainly in towns with a somewhat high-pressure service, and especially in towns possessing a constant supply. It is chiefly associated with the rising-main cold-water supply pipe to the house, and must not be confused with the noise peculiar to badly arranged hot-water services. Loose fittings at some point are the usual cause of water-hammer; but the noise may proceed at a point at some distance from its seat of origin. It may be heard, for instance, at the top, second, or hasement floors, or in all of these, and yet be caused by the screw-down stop-tap at the edge of the path outside the house. Ball-taps, more especially those of the undershut type, with a shackle or connecting link at the back, are frequent causes. If the shackles be worn too loose, allowing too much lateral or side motion, that may readily cause the noise, especially if the tap is not fixed



npright. Ragged cup-leathers or washers in ball-taps are another cause. The loose or hanging fragments, when water is flowing through, may set up sufficiently rapid vibration to cause a humming sound. Many other circumstances may cause water-hammer, which is often difficult to locate. If, after careful consideration and research, the noise cannot be located, there is a strong probability that it is caused in the company's main. Whether or not this is so can be ascertained by inquiring at the adjoining houses. In the case of small cottages that are all supplied by branch pipes from one main, the cause may exist in the house next door, or even in one that is two or three doors distant. As a last resort it is necessary to provide an air-vessel. A short piece of about 2 ft. or so of pipe, connected on beyond where a branch draw-tap is wiped, will often be found a good preventive. The two air-vessels illustrated—that shown by Fig. 1 being intended for use with horlzontal pipes, and Fig. 2 for use with vertical pipes—may be made up by the plumber out of about 1 ft. of stout 2 in. lead pipe, drifted and worked to shape, and the necessary pipe or pipes wiped on. In preparing the air-vessel shown in Fig. 2, care must be taken in fixing the inlet and outlet pipes, c and D, or the required object may be defeated; they must not approach each other within 1½ in. or 2 in. at E. F. or they will act as an air-pump and thus empty the chamber of air. Fig. 1 may be wiped or branched on to the top side of the pipe, somewhere near the point of draw-off, and Fig. 2 is for wiping into an ascending service pipe. The action of the air-vessel is thus explained: Instead of the water being allowed to rebound against bends or ends or sides of the pipe, and thus cause the tapping sound, the shock is absorbed by the body of air contained at G acting as a cushion or buffer.

Biuing Small Pieces of Steel.—For this put core sand into an iron ladle, heat over a fire until very hot, put the steel into the ladle, and shake the latter over the fire until the required colour is obtained.

Collapsible Clothes-drying Rack.—The collapsible rack filustrated by Fig. 1 will be found extremely useful for drying or airling clothes where the drying area is limited, because when not in use it occupies very little room, and when in use a large number of clothes can be hung in comparatively small space. Its back can be fixed to a wall, and the arms or spars, when required for use, can be placed in a horizontal position. Red deal or pine will do for the whole of the rack, but it will be advisable to make the bottom shelf of the hub of hard wood. When the arms are not in use they can be placed in the rack in the manner shown at B (Figs. 1 and 2). The different parts are fully dimensioned. The wall boards may be in one or more pieces, according to the width required, and then shaped and chamfered. The semicircular shelves to form the hub or arm holders should next be prepared, the top one P (Figs. 2 and 4) being quite plain, and, of course, smaller than the one underneath, which is notched out, as shown by C, D, E, and F (Fig. 4), to receive the ends of the arms. Next a semicircular piece G should be prepared, and must be of the same thickness as the dividing pleces H, K, L, and M. These pieces are made tapering, and should be secured to the lower shelf by glueing and screwing, the spaces being as nearly as possible of one size, so that, if the ends of the spars are carefully prepared, any spar will fit any space.



screwed to the outer edge of the lower of the top shelves. The complete hub is fixed to the wall piece by screwing through from the back into the edges of both shelves and the piece G; as additional support a bracket E (Figs. 2 and 3) should be fixed underneath. The bottom shell is (Figs. 2 and 3) supports the arms when in the rest, and is simply a piece of wood cut semicircular, and having a piece of hard wood, brass, or iron bent and screwed to its edge so as to prevent the arms slipping out. The shell is secured to the wall piece by screwing from the back, and is further supported by a bracket. As the greatest stress on the arms is at the place where they rest on the lower shelf, and least at the outer end, they can be made tapering, as illustrated.

Ink for Marking Tinware.—This may be made by working up asphalt or black varnish with turpentine. It must be kept in a corked or stoppered bottle, and is shaken thoroughly just before use. On withdrawing the cork, enough of the marking fluid adheres to it, and the pen can be filled from the cork. The ink is removed by rubbing with a cloth dipped in coal-tar oil or turpentine. Another suitable ink is made by reducing shellac varnish with alcohol, and adding finest lamp-black. This forms a dead black ink insoluble in water, though it can be removed with alcohol.

Syphon in Plumbers' Work.—A syphon is a tube bent in the form n used for drawing liquids out of vessels, either over the top or through the bottom. In the latter case the bend or top is some height above the bottom of the distern or vessel, and one leg is continued through the bottom, the end of the other leg being np a short distance above the bottom, for the water to enter. For the syphon to work, the discharging end must have a greater vertical length than the other,

so that the contents of the discharging end are the heavier. If the cistern or vessel had an air-tight cover, the ayphon would not work, as the pressure of the atmosphere would be excluded from the water in the cistern. A syphon will not work when the height of the bend is more than about 55 ft. 9 in. (when the barometer stands at 30 in.) above the surface of the water in the vessel. The syphons used and made by plumbers are generally plain bent tubes. But, in many of the patented appliances that plumbers fix, the syphons consist of an inner tube, or discharging leg, attached to the bottom of a cistern or tank, and an outer and larger tube, with a sealed or air-tight top, and open at the bottom. The water enters the latter, passes up the annular space between the two tubes, over the top and down the inner one. They are used principally—the smaller ones for flushing water-closets and drains.

Proportions of Oil Required in Grinding Various Pigments. — In grinding the different pigments, varying proportions of oil are employed by different manufacturers; and it will need little demenstration to prove that heavy pigments, such as white-lead, require less oil to reduce them to the condition of paste than doea, for instance, lamp-black, which, for an equal weight, has many times the bulk of lead. As may be seen from the following table, given by Professor Church in his handbook on the "Chemistry of Paints," the variation is very great;—

Required to Grind 100 lbs. of pigment.

Amount of Oil in lbs.

| | | \mathcal{L}_{A} | ccording | | According to Winsor and Newton. | | |
|-----------------|--------|-------------------|----------|-----|---------------------------------|--|--|
| | | | ettenkof | | | | |
| White-lead | ••• | ••• | 12 | | 15 | | |
| Zinc white | ••• | | 14 | | | | |
| Aureolin 🕳 | ••• | ••• | _ | ••• | 200 | | |
| Chrome yellow | | ••• | 19 | ••• | 32 | | |
| Yellow ochre | | | 75 | ••• | 75 | | |
| Raw sienna | ••• | *** | 240 | ••• | 180 | | |
| Vermilion | ••• | | 25 | ••• | 20 | | |
| Madder lake | ••• | ••• | 62 | | 125 | | |
| Terre verte | | ••• | 100 | ••• | 70 | | |
| Viridian | ••• | ••• | _ | | 75 | | |
| Prussian blue | | ••• | 112 | ••• | 75 | | |
| Cobalt blue | | | 125 | | 75 | | |
| Ultramarine (a: | rtific | ial) | | ••• | 3 7 | | |
| Raw umber | ••• | | | | 100 | | |
| Burnt umber | | ••• | | | 90 | | |
| Bitumen | *** | | _ | | 126 | | |
| Brown madder | ••• | | _ | ••• | 87 | | |
| Burnt sienna | | ••• | 181 | ••• | 195 | | |
| Bene black | ••• | ••• | 112 | ••• | 110 | | |
| | | | | | | | |

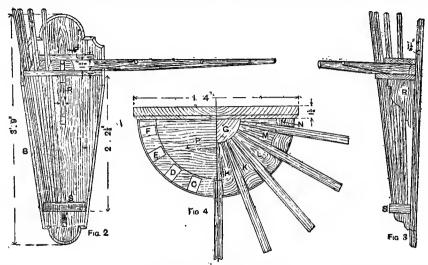
Laying Slates.—Slates are laid on battens or on close boarding; they are centre-nailed, or nailed at the head, and they are laid with close or open bond. The cheapest mode is open bond head-nailed on battens, but this is only fitted for outhouses and tool-sheds. When they are laid upon boarding, a layer of asphalted roofing felt or hair mortar may be interposed with advantage, to prevent draughts and extremes of temperature; and if slates be nailed to battens over the felt a small circulation of air is permitted, which helps to preserve the felt from decay. Centre-nailing is preferable to headnailing in exposed positions, as the wind has then only half the leverage to loosen the slates. When no felt is used the slates may be "shouldered"—that is, the heads for a width of 2 in. embedded in hair mortar, coloured with ashes, to keep the slates down tight at the talls. This is particularly suitable for exposed situations or rough slates. When laid on battens, the slates are frequently rendered all over the under side with lime and hair; but sometimes they are only torched, or durable. In all slating a double course is laid at the eaves, where the work of laying is commenced. This merely consists in cutting off the margin from one row of slates, but in common work the slates are laid lengthwise instead of being cut. The nails are of copper or composition (a sort of cheap brass), two to each slate, 1½ in. from the sldes. The slates have a gange or margin from 6 in. to 10 lin., and a lap of 2½ in. to 3½ lin., varying with slze of slate and mode of nailing. Following is a specification to govern the covering of a roof in a very exposed site with Countess slates (1 ft. 8 in. by 10 in.), including lead work in gutters, hips, valleys, and ridges: The roof to be covered with Engert and Rolfe's best inodorous asphalted roofing felt, laid with 2-in. lap upon 1-in. rough boarding, edges shot and closely laid. Slate battens, 2 in. by ¾ in., to be laid over the felt to 8-in. gauge to suit Countess slating, with thicker batten a

"shouldered" or bedded for about 2 in. at their heads in bair mortar mixed with coal ashes. To be laid in straight lines, vertical and horizontal, the eaves and ridge courses to be double, the eaves projecting 3 in. The ridges and hips to be covered with 4-lb. lead in wide pleces, nalled down at the edges under the slates, and dressed to the rolls after slates are laid, forming a double thickness on the surface of the slates without any nail holes showing. The valleys to be laid with 5-lb. lead and the gutters with 7-lb. lead over proper layer boards and fillets, turned up 6 in. under the slates, and 4 in. against wall with apron flashing. All necessary drips, cesspools, and outgoes to be formed in a workmanlike manner with 7-lb. lead bossed and soldered. Leave all perfect on completion. all perfect on completion.

Materials for Internal Plaster Work.—The basis of ordinary plaster is calcium carbonate, and of the hard coats calcium sulphate. The calcium carbonate or lime is generally pure or fat lime from the upper chalk, calcined and thoroughly slaked. The calcium sulphate or plaster-of-Paris is produced by the gentle calcination of gypsum to a point just short of the total expulsion of moisture. The hair is obtained from the tanner's yard, should be free from grease and dirt, and before use be beaten up or switched with a lath until the hairs are separated. Coarse stuff is a rough mortar composed of 1 or 1½ parts of sand to 1 of slaked lime by measure,

lime—i.e. lime to which plaster-of-Paris has been added in the grinding. Roman cement is used for internal rendering on damp walls, made by calcining septaria or notitudes found in the London clay. Portland cement, with sand in proportion of 1 part cement to 3 sand, is used for rendering walls to protect them from the weather. Portland cement stucco similar to last, but containing ohalk, is less liable to crack.

Flag Making for Decorations.—The Royal Standard may be of various sizes. Bunting should be bought in rolls about 1 ft. 10 in. wide, the colours being red, yellow, and blue. A flag 5 yd. long and ahout 5 ft. 6 in. wide will give a breadth and a half of bunting for each square of 1½ yd. side. Run and fell these lengths together by machine. The top corner square near the flagstaff is red, the opposite square yellow, the bottom square near the staff is blue, and opposite this and under the yellow is red. Of the figures for the three lions, draw and cut one out in brown paper, place it on the square at the top, making a chalk mark, place the paper again in position for the next llon, make a mark, and do the same again until the three lions are set out at equal distances apart. When the paper model is of the right size, fold the yellow bunting into three, place the paper model on it, and pin the whole together; then mark round the paper with chalk and cut out the three lions together. Place one of the lions on a flat board, and fasten it with Flag Making for Decorations. - The Royal Standard



Collapsible Clothes Rack,

thoroughly mixed with long ox hair in the proportion of 1 lb. hair to 2 cub. ft. of stuff for best work, or 3 cub. ft. of stuff in common work. The sand is heaped into a circular dish form, the lime placed in the centre and water poured over it until slaked, and then the hair added. The whole is then thoroughly mixed, and lett for a week or two to cool before use. Fine stuff is pure lime slaked to paste and afterwards diluted to the consistency of cream. It is then allowed to settle, the water rising to the top is run off, and the stuff is left till it is thick enough for use. A little white hair is added for some purposes. Plasterer's putty is pure lime dissolved in water and run through a fine hair sieve. It is always used without hair. Gauged stuff, also called putty and plaster, is composed of three-lourths to four-fifths plasterer's putty and the remainder plaster-of-Paris. It must be mixed in small quantities, as the plaster-of-Paris causes it to set quickly. The proportions depend on the nature of the work and other circumstances. Laths are strips of wood, fir or oak, about 1 in. wide and 3 ft. or 4 ft. long. They may be single, lath and half, or double laths, according to their thickness. Rough: rendering is the first coat laid on the naked surface of walls after raking out the joints, and is of coarse stuff containing a little less hair than that used for lath work, and applied in a moister state. Keene's cement is made by recalcining plaster-of-Paris after slaking it in a saturated solution of alum. Parian cement is produced by mixing calcined and powdered gypsum with a strong solution of borax, then recalcining, grinding, and mixing with a solution of alum. Martln's cement is made in the same way as Parian, carbonate of potash being used Instead of borax. Selenitic plaster or Scott's cement is made of selenitised

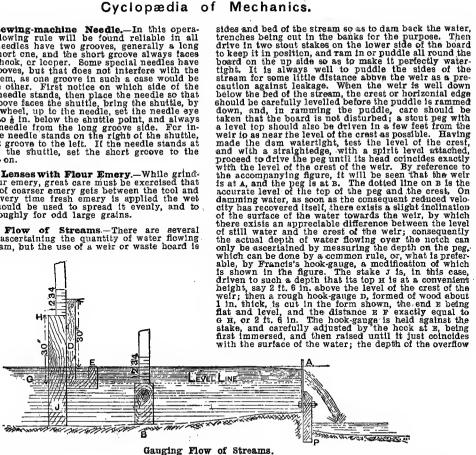
two or three drawing-pins, but do not stretch the bunting too tightly. For painting the lions, etc., the oil colours required are burnt stenna and black in tubes. As these colours are both slow driers, mix japan black with the tube black. Also get some gold-size and a little boiled oil and turpentine, mix these in equal quantities, and use the mixture for thinning the colours. First rub up the burnt sienna with the gold-size, then thin it with the oil medium. Now with a flat fitch brush and the burnt sienna paint in all the parts of the lion, such as the head, mane, legs, and tail. This colour acts as a shading for the black lines. For the black, use a round sahle such as sign-writers employ; with it finish the lion. The other figures are painted and finished in the same way. Having finished the figures in each separate square, run and fell the four squares together, taking care that the heads of all the figures face the flagstaff, and finally a strip of white canvas about 5 in. wide is doubled and sewn on the two squares next the flagstaff or the rope lanyard fixing the flag. To make flags bearing lettering, first cut out the letters in brown paper, then place the brown paper model on bunting of the required colour and mark all round it, leaving a margin for fixing, as the letters are run and feled in the same manner as the figures. The best way is to stretch out the flag and on it draw straight lines on which to place the letters, having them all in their places before commencing to fix them.

Gilding Caff- or Sheep-skin.—To gild calf- or sheep-skin, wet the leather with some egg albumen, and, when dry, ruh it with the hands damped with a little olive oil. Then apply the gold leaf, and pass a hot from over it.

Setting Sewing-machine Needle.—In this operation the following rule will be found reliable in all cases. All needles have two grooves, generally a leng one and a short one, and the short groove always faces the shuttle, hook, or leoper. Some special needles have two long grooves, but that does not interfere with the setting of them, as one groove in such a case would be equal to the other. First notice on which side of the shuttle the needle stands, then place the needle so that the short groove faces the shuttle, bring the shuttle, by turning the wheel, up to the needle, set the needle eye from $\frac{1}{2}$ in, to $\frac{1}{6}$ in, below the shuttle point, and always thread the needle from the long groove side. For instance, if the needle stands on the right of the shuttle, set the short groove to the left. If the needle stands the front of the shuttle, set the short groove to the back, and so on.

Grinding Lenses with Flour Emery.—While grinding with flour emery, great care must be exercised that not a grain of coarser emery gets between the tool and the lens. Every time fresh emery is applied the wet finger-tip should be used to spread it evenly, and to search thoroughly for odd large grains.

Gauging Flow of Streams.—There are several methods of ascertaining the quantity of water flowing down a stream, but the use of a weir or waste hoard is



the system that affords the most satisfactory results. Should the stream be very wide, it may be impossible to establish a weir; resort must then be had to cross sections in order to ascertain the sectional area, and the surface velocity of the stream must be ascertained by means of floats (from which the mean velocity must he deduced) or by a current meter. The best experiments give a mean velocity, throughout the section, of 84 per cent of the maximum central surface velocity, which is usually the velocity observed, being easily obtained by a float on the aurface of the stream. Floats may be made of balls of wood, wax, or other bucyant material, of from 1 in. to 3 in. in diameter. The corresponding mean velocity for open channels, canals, and rivers throughout the section, with an observed maximum velocity of 1 ft. per minute, is, according to Box's "Hydraulica," 84 ft. Thus, a channel whose area is 24 sq. ft. has a central surface velocity of 35 ft. per minute, the mean velocity by the table is 294 ft., and the discharge will be 294 × 24 = 705 c oub. ft., or 705 c × 6 c = 4,410 gal. per minute. The point at which it is intended to observe the velocities should be in as straight a part of the stream as possible, and where the banks are free from obstruction or other causes of undue retardation of the flow. Stakes should be driven at equal distances at two or more stations, between which any accurate cross-sections of the stream should be taken in order to ascertain the mean sectional area. Place the float in the centre of the stream some little distance above the first station, and notice the exact time it passes this and the other stations, and repeat the operation several times so as to arrive at a correct result. These observations should never be made in windy weather, as the progress of the ficat will be materially affected by wind. For gauging small streams by means of weirs or waste boards, having decided upon a point in the observations, measure the widths of the stream at the observations, measure th

is then measured by the distances from the top of the stake to the top of the gauge at F. The following abridged table gives the discharge of water over weirs 1 in. wide in gallons per minute. The full table will be found in Box's "Hydraulics":—

Detth in

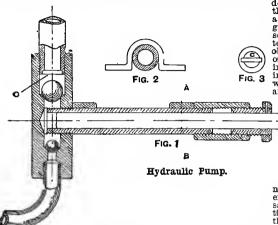
| Depth in inches. | | Gallons. | Depth in inches. | Gallons |
|------------------------------|-----|----------|------------------|---------|
| 1 | | 2.670 | 6 | 39.24 |
| 14 | ••• | 3.185 | 7 | 49'45 |
| 1 | ••• | 3.818 | 8 | 60*41 |
| 1 <u>1</u> 1 2 | ••• | 4-095 | 9 | 72-09 |
| 12 | ••• | 6-167 | 10 | 84.43 |
| 2 ⁷ | ••• | 7.552 | 15 | 155.1 |
| | ••• | 13.87 | 20 | 238.8 |
| 4 | ••• | 21.36 | 25 | 333'8 |
| 5 | | 29:85 | | |

As an example, supposing the rectangular notch is 1 ft. 3 in. wide, and the depth of water on the top of the peg is 1½ in., by referring to the first oclumn of the table, a depth of 1½ in. gives 6 167 gal. per minute for a width of 1 in., and as the notch is 1 ft. 3 in. wide, then 6 167 x 15 = 92 505 gal. of water per minute flowing down the stream at this point. These results are calculated for a crest of thin plate; and, as in the case of wide streams, where the volume of water would be too great for a thin plate to resist and yet maintain its regularity, it may be necessary to have the weir of stout planking 2 in., 3 in., or more in thickness. In such cases the lip of the weir, as well as the vertical sides of the notch, should be accurately beveiled to an angle of 45°, and the wood forming the weir should be hard, in order to ensure a perfect arris.

Closing Leaky Wooden Tanks.—When wooden receptacles leak it often happens that the wood is dried up, this causing the joints to open, and a common method of overcoming this is to pour in water intil the wood is swellen again and the joints are closed. This is sometimes a long job, and a quicker method is to sinfi the receptacle with straw or waste bad hay, laying a stone on top of this and then filling with water. Although the water runs away at first, the wet material remains and greatly helps in swelling the wood.

The Strength of Toothed Wheels.—The safe pressure at the pitch line is stated differently by authorities, and much depends on local circumstances as affecting vibration and shock, and on the material and mode of manufacture. The ideal condition of working is when the load is distributed equally across the whole width of the tooth, and this is approached most closely in wheels having machine-cut teeth. Ordinary cast wheels when new should be rnn very carefully and with a light load at first, so as to ascertain whether there are any lumps on the teeth; if existing, these lumps should be filled down so as to distribute the wear with some approach to evenness. The power that may be transmitted by a cast-iron spur wheel of 4-in, pitch and 1 ft. in breadth, running at a speed of 1,000 ft. per minute at the pitch circle, according to different authorities, is as follows: Nystrom, 155 horse-power; Unwin (moderate shock), 186 horse-power; Musgrave, 192 horse-power; Molesworth, 200 horse-power. Steel wheels will transmit from 30 to 50 per cent. more power than the above.

Simple Hydranlic Testing Pump.—The pump here illustrated is designed for use in testing a small boiler, and for similar purposes; it will fulfil the purpose of pumps of costly design and workmanship, and can be built for a few pence. It consists of a rod of solid brass or gun-metal drilled out to the required sizes as shown in Fig. 1, and fitted with ordinary iron gas or steam



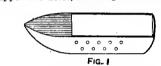
bends at the top and bottom of valve box. The upper pipe carries a small cross-bar to keep the discharge valve from blocking the outlet c (Fig. 3). The two valves are the ordinary playing marbles (glass preferred, as these are far more perfect in shape than the clay ones), which drop into the seatings made by the drill. The centre of the piece of gun-metal or brass is drilled and tapped to which is determined by the length of stroke the pump is to have. The gland end of this piece of tubing is countersunk as shown, and an ordinary socket fits over this, wherein is screwed the gland, which consists of an ordinary nipple, also countersunk; and for screwing up the gland a back nut is fitted, and secured by a rivet to keep it from turning. Before fitting the pump plunger it is as well to file the barrel out roughly, to get rid of any soale or inequalities left from the plup mandrel, and the plunger can be turned to fit it loosely; one end of the plunger has two flats filed on it and a hole drilled for a pin, and the pump is complete. For securing in position, two ordinary bent clips embrace the barrel near the ends, as shown in Fig. 2, and in section through A B (Fig. 1). This pump would stand a pressure of 250 lb. per square inch easily.

Jarrah and Karri Wood Pavement.—Jarrah (E.

Jarrah and Karri Wood Pavement.—Jarrah (E. marginata) is found in immense forests in Western Anstralia, the trees reaching heights of more than 100 ft., with stems 3 ft. to 5 ft. in diameter, and 50 ft. or 60 ft. from the ground to the first branch. It is described as a semi-coastal tree—that is to say, it is not found anywhere strictly beyond the influence of the sea, and yet it does not grow in near proximity to the coast line. As a rule, the best timber is found twenty to thirty miles from the sea. From experiments described by Mr. James P. Norrington, surveyor to the vestry of Fulham, blocks of Jarrah, 9 ln. by 4 in. by 3 in., after being kept in an office for several weeks, near a fire,

showed only fine cracks, while deal blocks of the same size developed large openings extending across the blocks, which were warped. The weight of a cubic foot of Jarrah was 51'96 lb., compared with 33 lb. for deal, the specific gravities being respectively '832 and '52. The maximum absorption of water by Jarrah wood is said to be 10 per cent. of its own weight, as compared with 23 per cent in deal. Karri, which is similar in many respects to Jarrah, grows to a larger size than the latter; an average troe, it is said, being 200 if. high and 4 ft. in diameter at a little distance from the ground, while the height to the first branch is about 120 ft. The timber is red in colour, and has very much the appearance of Jarrah, being hard, heavy, elastic, and tough; but it is difficult to dress. Karri is almost twice as heavy as deal, the weight of a cubic foot being given as £2'91! lb., compared with 35 lb., the weight of a cubic foot of deal. Its absorption of water is stated to be, at its maximum, 7 per cent. of its weight, as compared with 25 per cent. in the case of deal. Karri and Jarrah both make excellent wood pavement. Their superior hardness gives them lasting qualities, whilst their non-absorption obviates sanitary defects. They are easily kept clean. It is claimed that they are not so slippery as other woods, and eucalyptus oil being well known as a disinfectant, the argument has been put forward that these timbers have, on this account, a sanitary influence.

Threading Sewing-machine Shuttles.—Many modern shuttles are self-threading, or require very little threading; but the old-style boat-shape shuttle needs a little explanation, as the wrong threading of it often gives considerable trouble. This shuttle generally has several holes through which the thread passes in order to obtain sufficient tension, but this is not the sole object of these holes. By varying the thread, the amount of slack given off by the shuttle can be regulated. For instance, Fig. 1 shows a shuttle which has nine holes in it. The correct way to thread it would be to begin with the top hole nearest the heel, and thread it in and out of the upper five holes, finishing with the hole



Sewing-machine Shuttle.

nearest the point. If the tension there was not strong enough, thread through more holes but finish at the same hole, the one nearest the point. Theoretically, this is the right method, yet a machine, if threaded in this way, would not always make a perfect stitch; hence it is necessary sometimes to finish threading a hole or two farther from the point, and sometimes it is compulsory to finish in one of the lower holes. As a rule, let the cotton pass out of the hole nearest the point, and then, if more slack is required, thread back a hole at a time till the right stitch is attained.

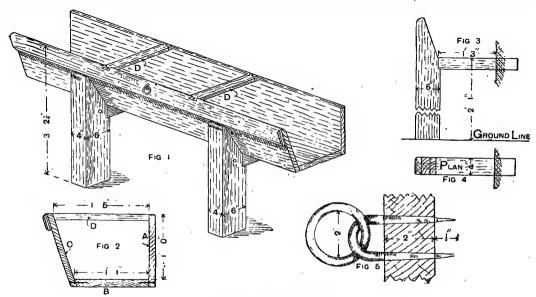
and then, it more stack is required, thread back a hole at a time till the right sitted is attained.

Manufacture of Borax.—In preparing borax from boronatrocalcite, or borate of lime, the operations include (1) boiling the mineral with soda, (2) working up the residual mud, (3) fine crystallisation, and (4) working up the lyes. In the first operation, the mineral is ground in boiling water, and calcined carbonate of soda is added in slight excess. The clear solution obtained when the boiling is over is run into rectangular iron tanks and allowed to crystallise. The resultant product is very impure, containing only from 40 to 50 per cent. of borax, the rest being sulphate of lime and common salt. The second operation of working up the residnal mud is a simple one of washing with water and subsequently evaporating to crystallisation point. The third process requires considerable knowledge. The rationale of the process depends on the fact that at a certain temperature and at a definite degree of concentration, borax will crystallise out from its admixture with the impurities mentioned above. An important point is to see that the borax crystals are of the variety that contains 10 molecules of water; because if the solution is too concentrated, crystals containing only 5 molecules of water are formed, thus leading to a commercial loss. The crystallisation vats are rectangular and of iron cased with wood, the interspace heing filled with nonconducting material in order to attain equable conditions of cooling. The filled vats are covered over and allowed to stand untouched for fourteen days, when the surface will be found crusted with borax crystals while the sulphate of lime remains in solution and can be run off. The fourth operation, the working up of the mother liquors for the small quantities of borax contained, is of little importance.

Piece Moulds for Plaster Casts.—Before a piece mould is taken, the object to be moulded will generally need rubhing over with some kind of dressing to prevent eticking. On marble, white curd soap is used; on plaster, hog's lard. For obvious reasons, it is well that the dressing should be colourless. Clean water only is used for mixing the plaster for the inner mould, and, when mixed, the plaster is not poured or thrown on as in waste moulding, but allowed to stiffen slightly, and then built up in its place with a spatula. A spot is chosen, generally a central one, and on this a piece of mould, about \(\frac{3}{4}\) in. thick, is built up so large only as will permit of its being pulled away without meeting with any obstruction. When set, it is removed; if necessary, a genile tap or two may be given to loosen it, Its edges are trimmed with a knife, and greased; it is then replaced. Two more pieces of mould are then built, one on each side of the first. These also are so arranged that they shall "leave" freely; they also, in turn, are taken off, trimmed on all sides except those which fit against the first-made article, greased, and replaced. The work is thus continued till the whole object is covered with pieces of mould differing in size and shape as may be determined by the necessity for making every one of them to "leave" readily. An onter mould is now formed, covering the pieces of the inner

in the shades, and a green will look blue in the lights; a crimson silk will be scarlet in the lights, and almost a black in the shadows. Gold appears black or invisible in parts, according to the light in which it is seen. For this reason, gold is generally outlined with black or dark brown. By artificial light, green appears blue; crimson, purple; purple, violet; yellow, white; dark purple, black. All colours show a different effect when on different planes, and tones of colour obtain their value from their situation, as well as from their contrast with each other. It is advisable, therefore, to try all colours in the positions they are intended to occupy, and in the light in which they are to be seen. Colours which are incongruous when seen side by side, or overlapping, give satisfactory results when separated by a line of white, black, or gold, according to circumstances. These three colours compensate for strong colouring; being themselves neutral, their presence helps to give the necessary neutralisation.

Cart-horse Stable Fittings.—Fig. 1 illustrates a manger suitable for one stall, 6 ft. wide, the racks being continued throughout the length of the stable. Elm, being tough and durable, is the best wood to use in constructing a manger. The section shown in Fig. 2 is generally preferred by farmers. The back board A



Cart-horse Stable Fittings.

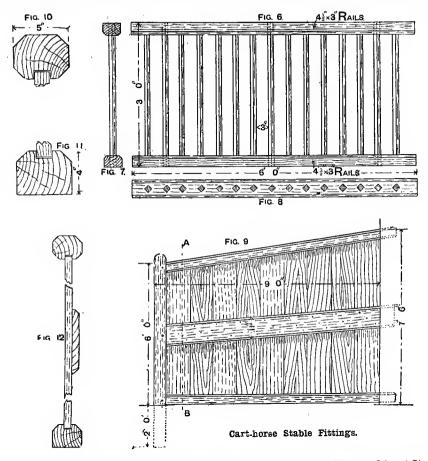
one and binding them together. If the object moulded is tolerably flat, the outer mould may be in a single piece. If it is an object in the "round," such as a bust, the outer mould will be in two halves, which will need tying tightly together before being filled. A little hog's lard rubbed over the inside of the mould prevents the cast sticking to it. The cast does not need to be made so thick as in a waste-mould, as the pieces of mould can be pulled away one by one by thumb and fingers. When the mould has been removed from the cast, it will be seen that raised lines remain, corresponding with the boundaries of the pieces. In a new mould these will be faint, but they become more marked by wear, and have to be removed with glasspaper.

Colour Effects Dependent on Situation.—The effect of colour depends on its situation, the light in which it is seen, and the colours associated with it. In a dimly lighted room, strong pure colours may be used, but the same colours would look bad in a strong light; a medium light is best for colour. Surface reflection also has a considerable effect upon colour results, a polished or varnished surface differing greatly from a reticulated surface. A number of contrasts must also be considered. There is contrast of tone, the gradations of a colour towards white and towards black; contrasts of hue, the gradations of one colour towards another colour—say from red to yellow, or red to blue, or blue to yellow; contrasts of texture, where various shades or colours are shown, according to the light that falls on it. For instance, an orange-coloured silk will look yellow in the high lights and brown in the folds; a blue will be violet

is 1 ft. wide by 1 in. thick; and the bottom B 1 ft. 1 in. wide by 1½ in. thick. The front c has a strengthening piece on the top edge, into which the cross-bars and rings are fixed. The short rails D (Fig. 1), which should be made of oak, serve two purposes—they keep the food from being tossed out, and strengthen the manger. The posts and bearers for supporting the manger in position are usually made of oak, and are framed and pinned together as shown in Figs. 3 and 4. Rings for securing the horses are fixed to the strengthening piece of the manger with strong staples, long enough to go through the front board and clench on the inside, as shown in Figs. 5. The racks above the manger are made as shown in Figs. 5. The racks above the manger are made as shown field. The states of these staves should go through the rails and be pinned, the remainder of the staves being elimply stumped in 1½ in. deep, as shown in Fig. 6. The width of the racks varies according to the height of the ceiling; but it is usually about 3 ft. Fig. 6 is an elevation of a rack suitable for one stall, and Figs. 7 and 8 show, respectively, section and plan. Partitions are made for exparating the animals. Fig. 9 illustrates a good strong and easily-made fitment. The stall-post is of oak, 6 in by 6 in., 6 feet standing out of the ground. Two grooved rails of deal or oak, 4 in. by 5 in., are framed into the post and pinned into the wall. The filling in boarding, and a 11-in. by 1½-in. chamiered ledge, tastened to the stall-post and wall, complete the division. Figs. 10, 11, and 12 are details of Fig. 9.

Cleaning Aluminium Utensils.—If an aluminium utensil is put away dirty in a damp place it may in time darken, and this darkening is largely due to the accumulation of dirt, etc., and to some extent elso to chemical action upon the metal itself—a true tarnish; but discolouration is avoided by occasional washing and rubbing. Wash each utensil in hot water and plenty of soapsuds, dry it with a cloth, and place it empty on a hot stove for a tew minutes to dry quickly and thoroughly. Do not boil ashes, lye, or alkalies, such as soda potash, ammonia, etc., in an aluminium utensil, as these substances attack the metal and blacken it, and water containing any of them will affect the utensils in a similar manner. Water containing sewage or other contamination will discolour an aluminium utensil, this

of the joints between the paving blocks with some substance which would keep out water as much as possible. Almost all wood pavements are laid on a concrete foundation, varying in thickness from 3 in. up to as much as 1 ft., according to the nature of the subsoil. In some cases the concrete is made with Portland sement; in others lime is used. At Ipswich a 3-in. foundation of Portland cement concrete is used, the concrete being composed of 1 part of cement to 5 parts of shingle and 1 part of sand. The thickness adopted in most towns is 6 in., as in Birmingham, Bristol, Cardiff, Edinburgh, Huddersfield, Hull, Leicester, Lincoln, Liverpool, Manchester, Newoastle, Sunderland, York, and the London districts of Fulham, Hammersmith, Holborn, Lambeth, and Westminster. A thickness of



being due largely to the presence of ammonia. Should the aluminium become discoloured, the fault lles with the water used. This discolouration may be prevented by using water which has previously been well boiled. The insides of aluminium utensils may, when necessary, be scoured with bath brick dust or special preparations largely advertised. Use any good metal polish for the outside.

Foundations for Wood Pavement.—The porous nature of wood when used as a paving material allows water to penetrate through the pavement to the foundations much more readily than through a stone pavement, and in the early days of wood paving it was found that the ballasting or earth upon which the blocks were laid used to work up through the joints in the form of mud, until the foundation became gradually destroyed, and the pavement fell into bad condition. A partial remedy for this defect was found in the formation of a platform of planks on which the blocks were laid. The ballasting was kept down by this, and the evenness of the pavement was also maintained. A much better remedy, however, was the formation of a foundation in a material—concrete—which was not affected by water, especially when this was accompanied by the filling in

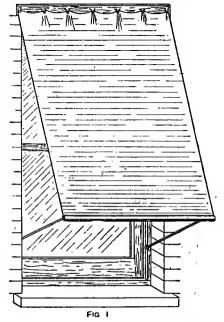
8 in. is used at Nottingham, and 9 in. at St. George's-in-the-East. Lime concrete 6 in. in thickness, with a facing of cement 2 in. thick, is used at Bath. Lime concrete is also used at Bradford. Sometimes a layer of sand or fine gravel is interposed between the blocks and the concrete foundation for the purpose of bedding the blocks upon, and, besides answering this purpose, it is found, where the joints are run in with pitch or asphalt, that it assists in keeping the blocks from rising from the foundations. The bituminous mixture penetrates the sand underneath the blocks, and adheres to the under surface of them, sticking them down to the concrete. Otherwise there is sometimes a tendency for the whole pavement to rise from the foundation through the swelling of the wood from moisture. A layer of sand, ½ in. or 1 in. thick, is used in this way at Carlisle, Derby, and other places in different parts of the kingdom.

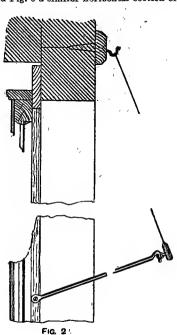
Planishing Hollowed Sheet Metal. — Hollowed bright sheet metal is generally planished on a planishing wheel, that is a machine which has top and bottom wheels of hardened bright steel. The hollowed body is placed between these, and pressure is exerted by the wheels on the mctal.

Manufacture of Bamboo Paper.—For this the young branchless bamboos are usually cut during May or June, when the plant is 4 ft. or 5 ft. high. First the stalks are crushed with a wooden hammer and placed in a cemented tank 5 ft. long, 3 ft. wide, and 4 ft. deep. They are covered with water, some lime is added, and the material is left to decompose for about forty-five days. It is then removed, washed with fresh water, and placed in a second pit of the same size as the first one, where it is allowed to soak for a further forty-five days or more. The fibrous matter, much softened, is placed in a stone mortar, with which is used a stone pestle worked by foot similar to the Chinese rice-cleaning mortar, and the material is reduced to pulp. It is placed on a platform and part of the water trodden out, the sticky pulp then being removed to a third cement vat partiy filled with clean water, and being stirred until the mixture bas attained the right consistency. For the final operation is used a screen consisting of a frame 2 ft. 4 in. by 9 in. supporting brass wires running crosswise and lacquered bamboo strips lengthwise, forming a fine network. A second frame of thin wood fits closely on the screen, its outside rim being

bamboo fibres, which are often so slightly incorporated with the body of the paper that they can be shaken off. The sheets measure 1 ft. by 2 ft. 5 in.

Outside Sun-blinds.—Two of the simplest sun-blinds in use are shown by the accompanying illustrations. Fig. 1 shows a hanging blind for a ground-floor window, and Fig. 2 is an enlarged section through the window, showing the hanging rail and the stretcher hooks. All the fixing necessary for this blind is the hook rail; this is made of 1-in. by 3-in. yellow deal, and is provided with a number of brass cup hooks, and fixed with screws to three joint plugs in the wall. Eyelet holes are worked in the top edge of the blind, and a strip of hard wood, teak for preference, is sewn into a hem in the bottom edge. A pair of straight iron hooks, from 1 fit. 6 in. to 2 it. 2 in. long, are screwed somewhat tightly to the edge of the window lining, and these engage with a couple of eyes in the wood strip, as shown in Fig. 2. Oiled calico or blue-striped union is a suitable material for this blind. Fig. 3 is the elevation of a spring roller blind and frame, Fig. 4 being an enlarged vertical section, and Fig. 5 a similar horizontal section of one side,





Outside Sun-blinds.

extended slightly to retain the quantity of pulp required for a single sheet. A third frame holds the two together, and, by its projecting sides, furnishes a grip for the hands during its manipulation. The whole implement is now dipped in the vat in such a way that the screen becomes covered with the pulp, and then is litted out horizontally and shaken slightly to distribute the pulp evenly. Most of the water passes out quickly through the netting, and, the outer frame heing removed, the inner frame is placed in an inclined postition to drain. When the water ceases to pass off, the screen is inverted and the soft sheet is allowed to fall out on a hoard arranged for that purpose. Thus the operation proceeds, the sheets being placed one on another until the pile is 3 in. or 4 in. high. The whole is covered by a second board and the pile placed under a long wooden lever near its fulcrum. Weights are placed on the free end of the lever, and the great pressure removes the superfluous water and gives compactness and firmness to the paper. On being released from the press the sheets are taken out four at a time, placed, in a split bamboo, and hung out in the sunshine to dry, or the sheets are kept, if the weather is unfavourable, until there is opportunity to dry them. This primitive process wastes much time, and not infrequently, owing to unfavourable weather, the whole operation takes six months. Sizing the grade of paper are unknown to the local Chinese, and the Formosan product is a thick, rough, coarse, straw-coloured paper, ahounding in partly macerated

with the roller in plan. This form of blind is more suitable for upper windows, and, if desired, the spring on the roller may be replaced by the ordinary rack pulley and cord. In this case a complete box about 4 in. deep is provided for the blind, the top and bottom being usually dovetailed into the sides, and the back and tront housed into them; with care, however, they might be made sufficiently strong by cutting off square and simply nailing together; the back and front rails a and 8 [Fig. 4) and the bottom c should be cut off between the sides D (Fig. 5), but the cover board E (Fig. 4), which is aloped to carry off the rain, is run over the edges of the frame flush with the ends, and projects \$\frac{1}{2}\$ in in front to cover the moniding. The case is fixed to the window by wall hooks, as shown in Fig. 5, and the bottom lath should overhang the blind on each side to engage with a series of hooks, driven at intervals into the frame back. A hook is also placed in the middle of the bottom to secure the blind when right down.

Colour Tones of Ancient Pigments—The pigments of the ancienta were never direct central colours, such as are found in rays of light. The reds, browns, and yellows of the Assyrians and Egyptians were inclined to be of a neutral tone. The red of the ancient Japanese was a very yellow tone of red, and their blue was greyish in tone. The Persians used a green blue, with a purple blue as a contrast. The Pompetans used a yellow which was practically an orange tinged with blue; their

red can only be imitated by the use of various modern pigments. It may, by varying the proportions of different pigments, be made to harmonise with the colour with which it is in proximity. It is made from a mixture of vermilion, ochre, or raw stenna or burnt stenna, with a small proportion of the umbers. The black of the Pompetans is best imitated by the use of the three primaries; it can never be matched even by the very best of the black pigments sold by modern manufacturers.

Belt Dressings.—A cheap and effective dressing is tailow; when a belt is pliable, only dry and husky, the application of blood-warm tailow, thoroughly dried in by the heat of the sun or fire, will tend to keep the belt in good working condition. The oil of the tailow passes into the leather, softening it, and the stearin is left on the outside to fill the pores and leave a smooth surface. The addition of resin to the tailow for belts, if used in wet or damp places, will help for preserve their strength. Belts which have become dry and hard

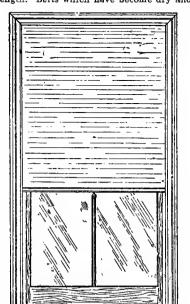
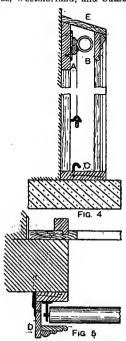


Fig 3
Outside Sun-blinds.

the threads hare. Again, in pictures painted on panels the grain becomes more prominent with age, and will be left bare unless carefully watched. In these two instances the restoring by colour would be very tedious. Pictures that have dried into the canvas should, after being carefully gone over with the damp leather, he freshened up with boiled linseed oil, carefully wiping all off again and polishing the surface with a silk duster.

Boulder Paving for Roads and Garden Paths.—
Most people are familiar with the old-fashioned cobblestone or boulder paving still to be met with in the streets
of small country towns. Its decidedly unpleasant
effects, both on foot passengers and those who travel by
wheel, constitute its most prominent characteristic, yet
only some fifty or sixty years ago this class of paving
was generally in use in our most important streets. It
is on record that as recently as 1840 boulder stones were
imported into Manchester and Liverpool from the sea
coasts of Wales, Westmorland, and Cumberland, for the



ehould be treated with neatsfoot oil or liver oil mixed with a small quantity of resin, the latter preventing the oil injuring the belt, and preserving it; the quantity of resin should not be sufficient to leave the belt sticky. Belts should not be soaked in water before oiling, and penetrating oils should but seldom be used, except occasionally when a belt becomes very dry and hard. It may then be moistened a little, and neatsfoot oil may be applied. For new belts a composition of tallow and oil with a little resin or beeswax should be used. Prepared castor oil dressing is good, and may be applied with a brush or rag while the belt is running. Belt dressings of any kind must not be applied too liberally to a new belt, or it will be liable to stretch and run out of line.

Cleaning Unvarnished Pictures.—Where there is no varnish on the picture, but the discolouration arises from smoke of fireplaces, lamps, tobacco, steam, dust, files, etc., no solvent must be used. Wipe off as much dirt as possible by means of a damp chamois leather, a little whiting on the leather being of great assistance. If the discolouration is very great a mixture of finely powdered Bath brick and pumlee powder in equal portions may be applied with the damp leather, and the whiting, Bath brick, and pumice may be used in combination. Great caution is necessary with this friction method, as it is more dangerous than any other. The canvas surface, on examination, will be found to consist of a series of elevations and depressions, and when paint is applied it sinks into the lower portions, leaving a thinner coat on the higher parts. Friction, therefore, naturally takes the paint off these raised parts, leaving

purpose of forming street pavements, while the same class of stones were brought from Guernsey and Jersey for use in the south of England. It is needless to say that they have now been supplanted in all important thoroughiares by squared setts. A boulder paving has many defects; it is very unpleasant to travel over, and it is, at the same time, very noisy. Another great drawback to its use is that, as the rounded boulders cannot be packed close together owing to their shape, great spaces are left, in which, as they cannot be reduced without much difficulty, horse droppings and filth accumulate. Water stands readily in the hollows, and to get rid of it a large amount of cross fall has to be given. The only advantage in such a system of paving lies in its great durability. It may also be pointed out that for garden paths it has a pleasing appearance, especially when arranged in patterns formed with stones of different colours. When used for street paving, the boulders are set upon a layer of sand, 3 in. or 4 in. thick, under which has been laid a good foundation. As a limit to the size of the stones, it is usual to specify that not less than forty nor more than fifty stones shall be laid to the square yard. In some cases the stones are graduated in size from the smallest in the centre of the road to the largest on either side.

Bearings for Long Shafts.—In bearings which have to support long lengths of shafts running at high speed, the brasses are supported on a spherical seat, and are allowed a little freedom of motion in the casing, both horizontally and vertically, to adjust themselves to the shaft.

Fixing Pearl to Glass in Glass-gilding.—To do this, first gild the outline, and when quite finished fill the spaces between the lines with very clear varnish. When this becomes tacky, put a little size on the end of the finger, pick up some of the flakes of pearl, and put them on different parts of the letter. Fill in with smaller flakes, and lastly press on some pearl powder to cover the space completely. Apply the varnish with a soft hair fitch, and to fix the pearl at the back, when the work is quite dry, press a layer of tinfoll well into the breaks. Paint over this with white-lead, tinted as may be required, and mixed stiff in boiled oil with enough japan gold-size to dry quickly.

Table-tennis Requisites.—The appliances for table-tennis are here illustrated, with the exception of the celluloid or rubber balls. Figs. 1 and 2 illustrate the racket; it is made of any hard wood that is not very heavy, and should be about $\frac{1}{16}$ in thick. The waste pieces left from sawing it out may be utilised in thick-

which four wire loops are fixed on a circle a little larger in diameter than the balls. The handle is 2 ft. 6 in. long and § in. in diameter. The loops are bent at the top as shown in Fig. 8, and when the picker-up is placed on top of the ball and pressed down, the loops are forced outwards and pass down over the ball, securing it. The picker-up is then lifted, and the ball taken out with the fingers. The wires should not be too stiff. An ordinary table is rather small for playing table-tennis, and it is convenient to make a loose table top much larger; about 6 ft. by 3 ft. 6 in, and 7 ft. by 4 ft. are convenient sizes. This extra top may be made of \$\frac{3}{2}\$-in. matched boarding, with battens on the under side, or clamps at the ends similar in size to a drawing board, and secured by cleats screwed at the back and then planed up level and true.

Granite, Syenite, Bath Stone, and Cralgleith.— An average granite may be expected to contain from two- to three-fifths parts of crystals of quartz or crystal-

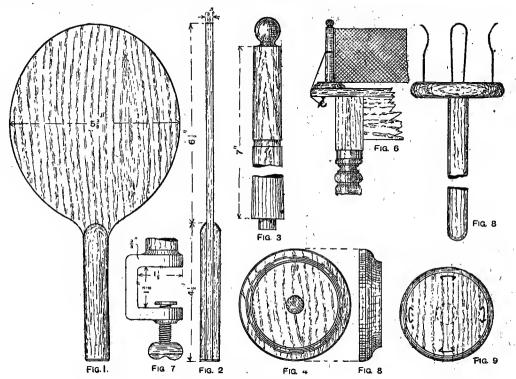


Table-tennis Requisites.

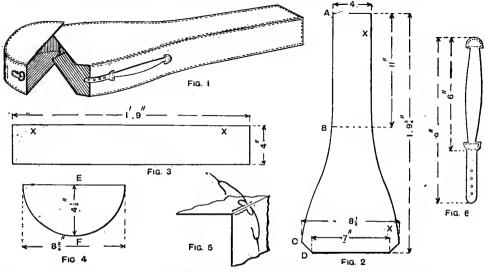
ening up the handle, as shown at Fig. 2, so that the cross-section is \(\frac{1}{16} \) in. by \(\frac{1}{2} \) in. Two racquets are necessary. The net is a piece of table-teamis netting, which may be bought at any large draper's for 2d. or iess. It should be hemmed at the top and bottom, and a string run through each hem from end to end. The net should be about 4 in. shorter than the width of the table, and is supported on two posts (Fig. 3); these are turned with a pin at the bottom, which is stepped and glued into the post bases (Figs. 4 and 5). These are \(\frac{1}{2} \) in. thick by \(\frac{3}{2} \) in. in diameter, and the post is fixed as shown in Fig. 6. Another method of fixing the post, shown at Fig. 7, is by using a screw clamp which has a hole drilled in the top arm to receive the post. When this is clamped to the table edge the post and net are firmly held. For the method shown in Fig. 6 a piece of tape is tied round a groove made half-way up the post, and is then passed down under the edge of the table and tied to a small screwed hook previously fixed underneath centrally on each side. The net is tied to the posts at the top and bottom at each end by the strings, and, when fixed, should be just stretched without strain. In playing, the balls continually fall to the floor, which necessitates a lot of stooping to pick them up. The picker-up shown at Figs. 8 and 9 will obviate most of this drudgery. It is made of a circular piece of hard wood about 5 in. in diameter and \(\frac{1}{2} \) in. thick, in

line quartz; about the same, more or less, of felspar, also partly crystalline and chiefly in definite crystals; and the remainder (one-tenth part) of mica. But the mica may form two- or three-tenths, and the quartz three-fifths or more, while the proportion of the felspar, as well as the particular composition of the felspar, both vary extremely. True syenite consists of crystals of quartz, felspar, and hornblende, the latter constituent taking the place of mica in ordinary granite. It derives its name from the granite of Syene, in Upper Egypt, though it has been shown that the latter is really a syenitic granite consists of quartz, felspar, mica, and hornblende, the last-named constituent being added to those of ordinary granite. Bath stone is an colitic lime-stone consisting of grains of carbonate of lime cemented together by the same substance or by some mixture of carbonate of lime with silica or alumina. Cratgleith is a sandstone composed of quartz grains united by a siliceous cement, with small plates of mica. It contains 98 per cent. of silica, and 1 per cent. of carbonate of lime

Flattening Sheet Metals.—If a sheet of metal has a wavy appearance along its edges, a few blows delivered at the centre will allow the sheet to rest flat. If the centre of the sheet has a swelling, give a few blows at each corner and one or two along the edges.

Case for Flat Mandeline.—For constructing a very neat imitation of a saddler-made leather case for a flat-backed mandeline, procure \(\frac{1}{2} \) yd. of American cloth (black), \(3 \) ft. \(9 \) in. wide, and some stout common caraboard for stiffening the case. Fig. 1 shows the case complete. First, two pieces of card should be cut to Fig. 2 for the top and bottom, two pieces to Fig. 3 for the sides, and two pieces to Fig. 4 for top and bottom of the lid. In Fig. 2 from C to D is 1 in., and from a to B is 11 in. One piece 4 in. square for the top end, and one piece 1 ft. 2 in. by 4\(\frac{1}{2} \) in for the lid, will complete the card shape. Now, with a sharp knife bevel all the edges on one side only, missing those edges which form the open end of the case and lid. This bevelling makes neater joins when the covered pieces are sewn together later on. Fit all the parts together to make sure that they are bevelled in the correct places; then cut out the American cloth to the same patterns, hut allowing 1 in. larger all round for the turnings in, making nicks in these where needed. The card shapes can now be covered with the American cloth, remembering that the bevelled side comes inside. To proceed with the sewing, put the edge x (Fig. 2) on x (Fig. 3) and sew the two pieces together, using the

wadding in each hand, saturate the piece in the right hand with the solvent, and the one in the left hand with rectified spirit of turpentine. Commence with the solvent, rubbing a very small portion (say two or three square inches) of the surface in a circular direction. After two or three rubs the solvent rubber will be discoloured by the varnish it has taken up; turn to a clean part and rub again, immediately wiping the place so cleaned all over with the turpentine rubber. The turpentine acts as a deterrent, instantly stopping the action of the spirit and hardening the paint. Judgment must be used to determine when the varnish has been completely removed. The cotton rubber must be frequently renewed—the more often the better—as the varnish taken up by the rubber stops the action of the spirit. Watch the rubbers for the appearance of colour, and at the slightest indication put the left-hand rubber into action. Continue the process until the whole of the picture is cleaned, and then wipe over with turpentine. When this has evaporated the surface is ready for revarnishing. For copal and other hand varnishes the stronger solvents, liquor potassæ or strong liquor ammonia, should be employed; but great caution is needed, for they are extremely strong. Keep the left-



Case for Flat Mandoline.

yellow-coloured thread sold for the purpose, and two needles as shown in Fig. 5; draw the stitches tight, but keep the two pieces at right angles with each other. Make the holes with a shoemaker's bent awl, placing them about ½ in. from each edge. If the two pieces are held together by a stitch at each end and one in the middle, the job will be made much easier. Proceed in the same manner with the other pieces, completing the case proper by sewing the square end piece on to the end, and making the lid by bending the lit. 2-in. strip round the circular side of the two pieces cut to Fig. 4. Now line the case and lid with thin baize, using strong glue, or the baize will not stick at the places where it covers the turnings-in of the American cloth. The hinge for the lid is a strip of black leather sewn on, and the handle and fastening are also made of the same material, being cut in one piece shaped like Fig. 6, a small buckle attached to the lid completing the case.

Removing Varnishes from Oil Paintings.—For this place the picture flat and carefully wipe off all dirt and dust with a damp leather. If the varnish is comparatively new it is easily removed by solvents, but it becomes more difficult to remove as its age increases. When the varnish is old it is a good plan to give the picture a fresh coat of varnish; when this is dry it will be found to have attached itself to the old layer, and both may be removed with a solvent. For soft varnishes such as mastic, spirit of wine of 56° strength should be diluted with a sixth part of linseed oil, or a fourth part of water, or a fourth part of rectified spirit of turpentine, or all in combination. Turpentine hardens the paint, making it safer to work on, while the oil prevents bloom, and the progress of the work can be seen better. To apply the solvent, which must be well shaken whenever used, take a piece of

hand rubber well saturated with turpentine and ready for instant use, and proceed in exactly the same manner as with the spirit of wine solvent. Should the picture be dull from hanging in a bad light, place it before revarnishing in a window iacing the sun for two or three weeks; this will restore much of its brilliancy.

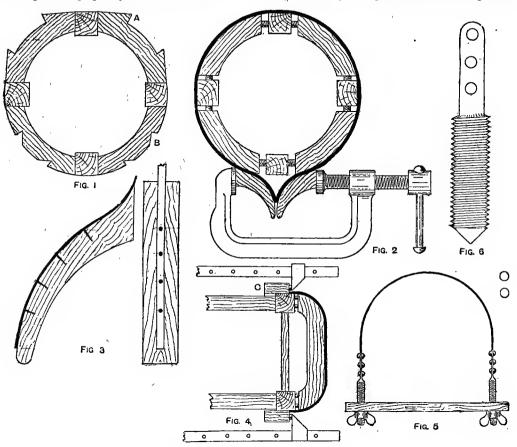
Origin and Preparation of Yellow Ochre and Raw and Burnt sienna.—Yellow ochre and sienna are natural pigments obtained from the rocks of several geological formations; they are found in this country in Derbyshire, Oxfordshire, Cornwall, etc., and in France, Italy, etc. These pigments are hydrated peroxides of iron more or less mixed with clay, etc., and are produced by the weathering, or oxidation and hydration, of minerals containing iron, principally iron pyrites. Yellow ochre usually occurs in veins or masses, and is mixed more or less with "gangue" or vein stuff, from which it has to be separated; on the other hand, siemna appears to have been carried by water, either in solution or suspension, and deposited in hollows in a nearly pure state. Yellow ochre is prepared for use as a pigment by first grindling it in an eage-runner mill, and then levigating it—that is, submitting it to a stream of water in a large tank; the water carries away the lighter particles of the pigment, and by allowing the water to flow through a series of three or more tanks the ochre is deposited, while the clear water runs away from the surface. When a sufficient quantity of the pigment has collected in the tanks it is dug out, placed on trays, and dried by heating it at a moderate temperature on a drying floor. Raw sienna contains little impurity, and is usually prepared by grinding it under the edge-runners. Burnt sienna is prepared from raw sienna by calcining it in a furnace at a low red heat until it assumes a warm reddish-brown colour.

Putting Handle on Golf Club.—Putting the grip or handle on a golf club is an operation done so rapidly that a skilled workman takes only a little more than a minute over it. For the best clubs horsehide is used entirely, but skeepskin, a fair substitute, is used on the other grades. The hide is cut into strips of the proper length and width by machinery, but the workman wraps the grip around by hand with a few dexterous motions, fastening the loose end with small brads or glue. Sometimes the entire shaft is covered with the finishing coat of varnish, but first the wood is saturated with shellac, which enters the fibre and plays an important part in protecting it from the weather. Over this is placed the varnish, and vigorously rubbed.

Joiners' Cramps for Circular Work.—One method of closing or cramping the joints in circular work with

horns in this case being replaced by rectangular pieces of hard-wood. The cramp is shown as applied to a curved couch end, the pressure being applied by a bar cramp at each side. This kind of cramp is useful for semi-circular work, auch as bow-front chairs, curved pediments, bell-shaped backs, etc. Fig. 5 illustratee a flexible cramp which is self-contained, the band again being of hoop-fron and riveted to steel or brass ends, which are threaded (see Fig. 6) to receive winged nuts. They pass through a stiff bar of hardwood, which keeps them in position, the cramping being done by tightening up the nuts. This kind of cramp applies to almost any kind of irregularly shaped work.

Impurities in Coal.—The impurities removed in the process of coal washing include slate, sulphur, hone coal and fireclay. The process of coal washing in briaf



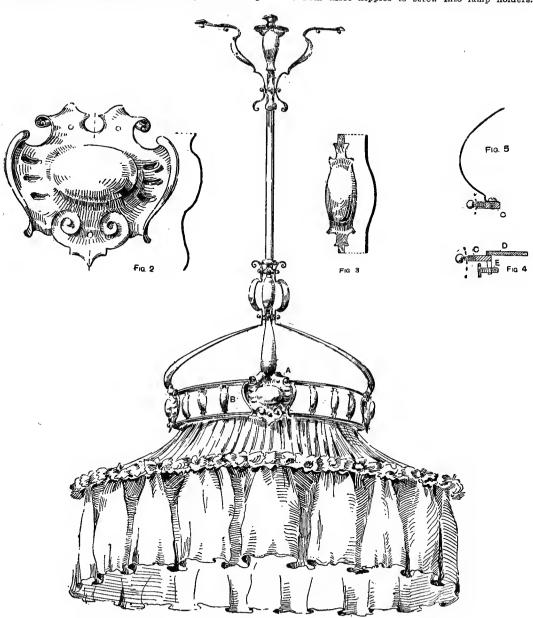
Joiners' Cramps for Circular Work,

straight bar cramps is to provide projecting clamping pieces A (Fig. 1). This is done when setting out the stuff, the cramp jaws embracing one cramping piece at each side of the leg, and the seat frame being dressed up afterwards. This method, however, entails a great waste of wood, for in marking out circular work it is of great economy to mark one piece with the other. Where the curved members act as stuffing rails to be covered by the upholstery, another method is to cut a piece out of the rails as shown at B, the cramp jaws in this case fitting in the notches, which are afterwards filled up by the pieces of wood being glued in again. But this method makes the frames very unsightly. The flexible cramp shown applied externally to a circular seat at Fig. 2 consists simply of a pair of beech-wood horns (Fig. 3) about 8 in. long by 2 in. thick, to which a narrow band of hoop-iron is attached by means of acrews or rivets. This hoop passes round the seat frame, and pressure is brought to bear on the horns by a hand cramp or by an ordinary bar cramp. The cost of these cramps is small, and a variety of sizes will be found exceedingly useful. Another flexible cramp is shown at Fig. 4, the

consists in allowing the heavier portions to sink to the bottom in a trough of water, the specific gravity of coal being from 1°27 to 1°3, and of slate from 1°5 to 2. Sulphur occurs chiefin as iron pyrites in solid dense masses which are removed easily. When the sulphur is in the form of thin flakes disseminated throughout the entire mass it is somewhat more difficult to remove, and if the lump is not heavy enough to sink the sulphur cannot be removed; sometimes the flakes assume a shallow cup-like form and float off, although heavier than the water. Sulphur occurs also as flakes of sulphate of lime and magnesia as thin as paper, but its worst form is organic sulphur, which cannot be detected by any physical inspection and cannot be removed by any physical process. Bone coal, an impure form of coal, is of a slaty nature, and it is difficult to tell how much of it is coal and how much refuse; frequently it gives great trouble in washing. The difficulty in removing irreclay is its readiness to emulsify in the water and form a sticky mud which fills up the holes in the screens, settles to the bottom of the tanks, and causes trouble generally.

Hanging Lamp in Metal.—The pendant illustrated in Fig. 1 is suitable for electric light, oil, or incandescent gas, and may be made in iron only, or with the shields in copper, or in brass and finished in oxidised silver. Inside is an opal disc to throw the greater part of the light on to the table, but allowing

oil lamp, the container may be supported by three stays from the lower ring, and the pendant may be suspended by a chain; there must also be a smoke consumer over the chimney. For electric light, there should be the ordinary ball body just below the opal disc with three nipples to screw into lamp holders.



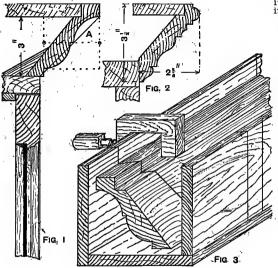
Hanging Lamp in Metal.

sufficient to pass through to light the upper part of the room. From the lower ring hangs a silk flounce, the colour of which depends on the taste of the maker and on the material and finish of the metal work; but a dark green or a crimson shade will answer most purposes. If the shade is to be made for gas, it must be arranged either with two or four small Welshach-Kern burners (say No. 1 size), according to the amount of light required. These burners are chimneyless. Also, the opal disc should have holes cut out to a diameter of 4 in. over each burner, and had better be in two halves to allow of removal for cleaning, etc. If fitted with an

Figs. 2 and 3 are respectively enlarged illustrations of the details A and B (Fig. 1). The rings C (Figs. 4 and 5) are made of \$\frac{2}{3}\]. by \$\frac{1}{2}\]. The rings C (Figs. 4 and 5) are made of \$\frac{2}{3}\]. by \$\frac{1}{2}\]. strip, and there are three screws and lugs E (Fig. 4) to support the flounce, D being the opal reflector. The shields and ornament should be carefully made, as the effect of the whole article when completed will depend largely on the workmanship of these parts. For better effect the hammer marks should be left in, and if the shields are to be in copper they should be rather dull, excepting on the projecting parts, this giving the work greater relief and much more artistic effect than when the work is polished all over.

The Lightest Solid.—This is said to be the pith of the sunflower, with a specific gravity of 0.028, while elder pith, once considered the lightest solid, has a specific gravity of 0.09, reindeer hair of 0.1, and cork 0.24. For life-saving appliances used at sea, cork is, of course, used, and also reindeer hair, with a buoyancy of 1 to 10, but the buoyancy of sunflower pith is 1 to 35.

Cornices for Bookcases, etc.—Two designs of cornices that are suitable for a plain bookcase are here illustrated; both are effective and easy working with hollows and rounds. Fig. 1 shows a broken ogee, the fillet in the centre adding considerably to the effect and making the moulding easier to work. The dotted lines indicate the method of setting out, the centres of the curves being as shown. The moulding can be worked out of i-in. stuff, and projects at an angle of 45°, as indicated by the line 4, but the amount of projection is a matter of taste. The vertical and horizontal edges should be squared, and the rebate for the cover board ploughed from the top face edge. The moulding sits on the top of the case, to which it is glued with angle blocks. Fig. 2 shows a more elaborate design arranged to nail on the face of the case, and to be worked out of \$in. stuff. Fig. 3 illustrates the method of cutting the mitres in

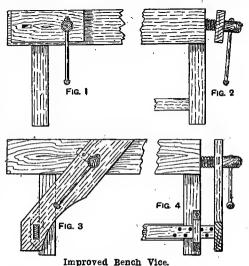


Bookcase Cornices.

an inclined cornice. A mitre box, about 15 in. long; and wide and deep enough to take the cornice, is made with three pieces of 1-in. deal nailed together, the sides being at right angles with the bottom. Two saw-outs are made across the sides at an angle of 45°. as shown, these cuts being perpendicular to the bottom. The moulding is placed in the box, with its lower edge fairly on the bottom and its front face against the side of the box containing the widest part of the saw-cut; it is advantageously fixed with a clip or handscrew, as shown, to keep it from slipping. Then the panel or tenon saw is passed steadily down the cut from the side on which the handle of the screw is shown. Next the moulding is removed and the mitred end slightly smoothed with a smoothing plane, a small American block plane being best. When correct, place the moulding in position on the case, giving it the required overhang, and temporarily fix it with a bradawl at the back. Then cut a mitre on the end piece adjoining the uncut end of the front length, prepare this mitre as before, and place it in position on the case, moving it forward until it touches the back end of the front cornice. Then, keeping it firmly down on its bed, a pencil line may be drawn across the top edge of the front plece, in line with the end plece; this gives the neat length of the front cornice, which should be put in the box with this line to the appropriate cut, and is then cut off a shaving ill and cleaned up to the line. Fix this piece firmly and fit the end pleces to it as described. If the mitres are cut correctly, little or no fitting will be required. A mark is made flush with the back of the case, and the end pleces are cut off square with this, and are fixed on the top, screwing being the easiest method. A fine brad or panel pin is put in through the face of each

mitre, and afterwards blocks are cut to shape and glued in one being rubbed on the back of each mitre. Then the cover board, § in. thick, is fitted and dropped in, one or two screws being turned in to keep it in place.

Improved Bench Vice.—It is surprising that so many joiners tolerate the old-fashioned form of bench vice shown by Fig. 1. The defects of this form of vice are obvious. Suppose, for instance, it is required to cut the tenons of an ordinary door, a piece of stuff of the exact thickness of the rail has to be inserted between the jaw and the bench at the opposite end to that in which the door rail is put, and, should the piece inserted be a trifle thicker or thinner than the rail, difficulty will be experienced in tightening the screw sufficiently to keep the rail rigid whilst cutting the tenon, and even then it will probably slip about and become loose. If it is required to plough, say, the edge of a mullion, when this is placed in the screw and tightened up the jaw tilts over as shown in Fig. 2, and grips the mullion hard on its two arrises; and in fixing it in the vice in order to plough the second edge, great care must be exercised to avoid splitting off pieces from the rail at each side of the groove, thus disfiguring the work. The form of vice illustrated by Figs. 3 and 4 deserves to be more generally known. The idea is, instead of having the jaw horizontal, to adjust it in a raking position; it will then grip the work on both sides of the screw, instead of only on one side as formerly, thus avoiding

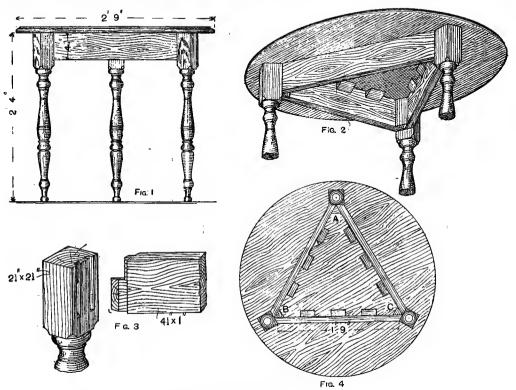


the tilt; and this advantage is assured whether the work be placed in the vice vertically, horizontally, or obliquely. Another good point in this arrangement is that the rail mortised into the jaw at its lower end may fit rather loosely in the socket screwed on to the bench leg. Holes are bored through this rail at certain distances apart, and in any one of these a pin is inserted. This pin answers the purpose of the blocks placed between the jaw and the bench when the vice is horizontal, with the advantage that, no natter in which of the holes the pin is placed, the vice will grip two or three thicknesses of stuff, thus avoiding the necessity of providing a new block every time work of a different thickness is put into the vice. It will also be found that with this form of vice the work can be held securely and satisfactorily by about a quarter turn of the screw.

Differential Gear of Motor Cars.—The differential gear forms a necessary part of nearly every automobile, whether steam, petrol, or electric, which has a single source of power. Its function, as its name indicates, is to allow of a difference in speed between the two driving wheels when the carriage is turning a corner. If the differential gear were not used, the driving wheels of a carriage equipped with a single motor would be forced to revolve at the same speed, and would slip injuriously in rounding sbarp curves. The differential gear is for the purpose of allowing the power to be applied so that each wheel may have its proper speed to take curves without slipping. When a separate motor is provided for each of the two driving wheels, the wheels, being independent, naturally assume their proper speed in turning a corner.

Three-legged Table with Round Top.—Fig. 1 is the elevation of a table on three legs with a round top. The latter would be formed by dowelling and glueing together two or more pieces of wood about 1 in. thick, after which each side should be planed true. Next strike out the top circle and cut to the mark by a narrow pointed saw or table saw, and finish the edge with a spokeshave. To mould the edge a scratch plane may be made from a piece of steel scraper, one end of which is filed to the shape required. The stock is of any hard wood, a hole receiving the cutter and wedge. The legs, obtained turned to pattern, should have their upper ends (see Fig. 2) planed true. The three rails should next be prepared, their ends being set cut for tenons and the legs for mortising and housing (see Fig. 3). The shoulders of the rails are not squared across the thickness, but are

The electrical connections between these various parts are as follows: One wire (a) from one battery terminal passes direct to one end of the inner (primary) coil of the induction coil, whose other end is connected (b) to one terminal of the contact breaker. From the other terminal of the contact breaker a wire (c) passes back to the other terminal of the battery. It is immaterial, as a rule, which terminals of any part should be connected to the next part, but in certain cases leakages may be reduced or rendere! less detrimental by changing over the wires. The condenser must be connected across the terminals of the contact breaker, and it is for this purpose that the wire (c) passing from the contact breaker direct to the battery is taken back to the induction coil, in the base of which the condenser is usually placed. The only other connections necessary are a carefully



Three-legged Table with Round Top.

inclined at 60° to the face. The difficulty of mortising may be minimised by fixing the legs in the bench screw, and then having a lath inclined at 60° to the bench top, holding the chisel while mortising so that it is out of winding with the strip. The tenons and shoulders may next be cut, the ends of the tenons being splayed; of course, when both tenons are pushed into position the ends should not touch, or else the shoulders could not be fixed close up. When all the joints have been fitted they should be glued together, and, when dry, the top of the legs should be planed off true. Then the top should be placed face downward and the framework adjusted to the under side and secured to the top by two screws driven obliquely from the back of each rail into the top. Additional security is given by angle blocks, as illustrated at Figs. 2 and 4. Blocks fitted and glued between the rails next to the legs, as shown at A, and C (Fig. 4), will add to the rigidity of the legs.

Electric Ignition for Automebile Motors.—When high-tension current is employed, the parts required for ignition are: (1) The battery, or source of electric current; (2) the induction coil, which transforms the low-tension battery current into a high-tension current; (3) the contact breaker isometimes called the trembler), which breaks the steady flow of current from the battery into intermittent waves; (4) the condenser, which trensifies the intermittent waves and also reduces the sparking at the contact breaker; (5) the ignition plug or air gap in the circuit of the high-tension current.

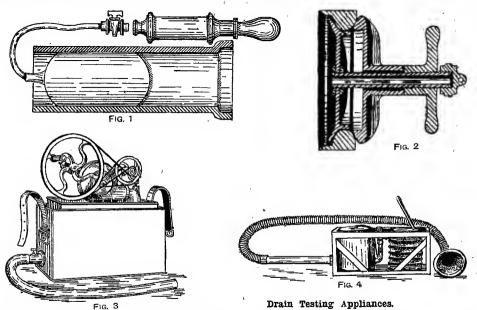
insulated wire (d) from the outer (secondary) coil of the induction coil to the central conductor of the ignition plug, and a connection (e) from the other end of this coil to the outer case of the plug. In practice, the machinery itself forms part of (e) connection (called "earth"), and in most cases the wide (d) should be connected to the end of the "secondary" that comes from the last wound layer. An ordinary switch is inserted in either of the wires (a) or (c) leading from and to the battery. With regard to the apparatus, when the contact breaker is actuated, waves of current flow from the battery. The high-tension current generated in the secondary winding of the induction coil, through the contact breaker itself, and back to the battery. The high-tension current generated in the secondary winding of the induction coil passes through the ignition plug, across the spark points, and back to the induction coil.

Remedy for Overheated Solder.—When solder is heated in an open pot, the upper surface is exposed to the air, and combines with oxygen from the latter. On heating to redness, the combination takes place to a greater extent. As the tin melts at a lower temperature, and its specific gravity is lighter, than lead, so that it floats on the latter when melted, the solder becomes "poorer" when too highly heated, owing to its oxidation. If the dross is melted with a flux, or with powdered charcoal, which will combine with the oxygen, the solder will again become fit for use, but it is sometimes necessary to add a little more tin.

Softening Hard Water.—The Clark process of softening hard water consists of mixing the clear effluent of lime slaked with an excess of water with that to be softened, which causes the chalk to settle at the bottom of the tank, leaving the water to be drawn into the storage cistern ready for use. The softening plant should be either on the ground floor, whence the water could be pumped into the storage cistern, or fixed above the latter, into which the water could be drawn.

Testing Drains.—The two chief methods of testing drains are: (a) By filling them full of water, and ascertain whether they leak; (b) by introducing into them some strong-smelling smoke, or essence, or chemical, and ascertaining whether any smell is perceptible along the line of the sewer. New drains, however, should be tested under pressure. The smoke test (taking the latter first) is applied thus: All outlets from the drain are stopped with clay, or some patent stopper (see Figs. 1 and 2). The smoke is produced in a machine with either a fan or a bellows arrangement (see Figs. 3 and 4), and sent into the sewer, with a slight pressure, by means of a tube; and the smoke finds its way out through any interstice that has not been properly filled with jointing material. This is a simple but not a very severe test.

the water still runs away, the test cannot be carried out. The introduction of essences or chemicals into the drain is slow, uncertain, and inconclusive. Currents of air in the pipes may prevent them travelling along certain portions of the system; density of the atmosphere may prevent them rising up the whole height of the pipes; and the use of a drain during a test may wash the whole of the odorous material out into the sewer, in which case, after waiting an hour or two and no smell being perceptible, it would be erroneously concluded that there was no escape of sewer gas. The smoke test thus remains the best test for existing drains. Close all known openings, including ventilation shafts, untrapped downpipes, etc., and let a labourer pump in the smoke, slowly at first, so as not to break the water-seal of guillies and water-closet. Be careful not to inhale the odour of smoke from the machine, or it will lodge in the nostrils and be perceived everywhere. Then carefully examine every pipe and every room in the house. It must be noted that the smoke may be perceived several feet or even many yards from the actual leakage, and this is especially noticeable in houses with cavity walls. Sewer gas (which in this case is smoke) escapes at some broken pipe or defective joint, travels along the outside of the pipe until it finds a cavity, and proceeds along the



A much more effectual method for newly laid drains is the water test, which is the only satisfactory method, making visible any defect, however small. The water test consists in blocking the lower end of the drain so that it is made watertight, and placing a standpipe at the upper extremity. The drain is then filled with water. If it will not hold water, the fact at once becomes apparent by the descent of the water in the standpipe. The water test is only what a drain might have to withstand if its lower end became choked. If it he watertight the level of the water within the standpipe will remain constant. If a drain will not hold water, it forms a danger to be remedied. It is desirable before turning on the water, to calculate the cubic contents of the drain approximately, and thus ascertain whether too much or too little water is being put in. The cubic contents are ascertained by calculating the area of the pipe in square feet multiplied by the length of the pipe in feet; this gives the result in cubic feet, which, multiplied by 64, gives the result in gallons. In testing existing drains, many difficulties are encountered which do not present themselves when new drains are being tested. Existing drains are covered in, their exact position is not known, their direction can only be guessed at; they may have unknown ramifications and connections, and the occupants of the house may use them during the test, all of which difficulties are non-existent when testing new work. The water test just described can seldom be used for existing work; it is impossible, for the reasons just stated, to calculate the amount of water that will fill the pipes, and difficult to ensure that every terminal will be stopped. If every known pipe is stopped, and

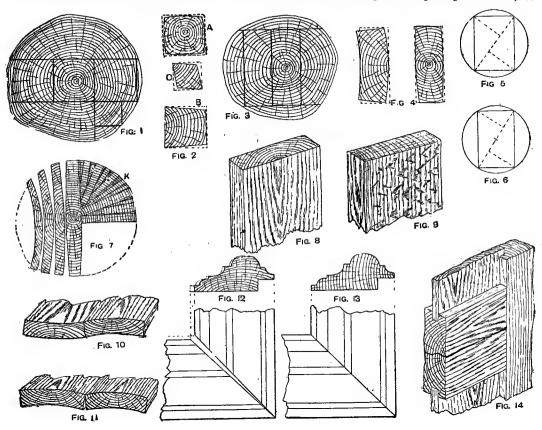
cavity until some defective mortar joint or other opening allows it to enter the room. This locates the defect, and the remedy will suggest itself.

Preparing Colours for Book-edge Marbling.—For grinding colours in the dry state a marble slab and muller must be procured. Large quantities are treated with a colour mill, which is simply a pair of porphyry rollers rotated in opposite directions close together. The colour has to be passed through several times before the proper degree of fineness is reached. After being ground, the colours are mixed in a cup with water. Besides the gum or size and colours, ox-gall, ammonia, spirit of wine, and oil will be required. Get a gall-bag from the butcher and cut a hole in the bottom to allow the gall to run into a bottle. Gall when new is often thick, but it will thin and improve with age. For the bottle, get a well-fitting cork and cut two pieces out of the sides opposite each other; then put the cork, when the bottle is turned up a drop at a time will come out. The ammonia and spirit of wine must be kept tight with ground glass stoppers. Some of the colours require a little besewax to prevent them rubbing off and to ald in the burnishing afterwards. It must be added while grinding. To prepare it, chop a small piece of besswax fine, and place it in a small tinned iron or in an enamelled vessel on a stove until it is melted. Then pour gradually into it some spirit of turpentine, stirring all the time until it acquires the coneistency of honey. Allow it to cool, when it can be added to any colour and ground with it when necessary.

Cutting Timber for Various Uses.—Fig. 1 shows square scantlings occupying three different positions in the same log; Fig. 2 shows the alteration of form in each piece after sawing and seasoning. It will be noticed that A undergoes the least change. At Fig. 3 two planks are represented occupying adjacent positions in the same log. Fig. 4 indicates the change in shape of each after conversion and seasoning. Fig. 5 represents the strongest beam that can be cut from a log, and Fig. 6 the stiffest. The centre plank and those to the left in Fig. 7 indicate how hoards cut from the log tend to shrink and warp if unrestrained. If the boards are cut as shown at K, there would be the least alteration in form. Timber should be cut as represented at Fig. 8 in order to show the figure formed by the annual rings. When it is required to obtain oak panels, etc.; showing the beautiful markings of the medullary rays, the timber should be cut as shown at Fig. 9. By arranging boards as in Fig. 10, a better joint is made than that shown at Fig. 11. When mouldings are prepared from

object is to exhibit the hearty grain, as Fig. 8. For this reason it is generally preferable to cut logs into hoards and planks parallel to a diameter. Wood cut in this manner, if it has not been thoroughly seasoned, has the drawback that when it is made up into framing, etc., it will shrink and split along the middle, as at Fig. 14, which illustrates the middle rail of doors. Splitting also occurs to panels tight in the plough groove.

Home-made Device for Decorating Glass.—For cutting initials, monograms, and ornamental borders or bands on glass articles, such as tumblers, bottles, hand mirrors, etc., with emery Dowder, the glass may be held stationary by any suitable means, and then all that is necessary is about 3 lb. of medium grade emery and a funnel having a tube from 4 ft. to 5 ft. long and ½ in. in diameter. The initial is cut through a paper stencil, which is fastened to the glass with muclage or held in place by rubber bands. The emery falling through the tube and striking on the exposed glass cuts it quite



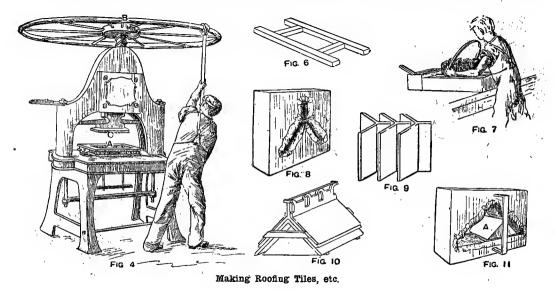
Cutting of Timber.

wood which has been cut so that the annual rings are nearly parallel to the breadth (see Fig. 12), there is almost sure to be more or less shrinkage, which will, of course, take place in the breadth and thus produce an open mitre as shown, although the workmanship may be first-rate. Fig. 13 shows the best arrangement, the annual rings being at right angles to the breadth. Timbers, to be of maximum strength, should be cut from the log so that the annual layers are parallel to the depth, as in B (Fig. 2) and in the left-hand sketch (Fig. 4). It has been proved by experiment that timbers which have the annual layers parallel to the thickness are the strongest. But if the principal object is the least change in form, the plank containing the centre of the log should be preferred; with eak, where it is desirable to show the beautiful figure of the silver grain, the log should be cut radially, as at x (Figs. 7 and 9). Most woods warp the least, and shrink least in breadth, when cut in this manuer. But it is a method not suitable to the cutting up of logs, the wood of which is required to be varnished or polished where the

rapidly, and three or four runnings of the emery will form the cut sufficiently deep. The stenoil should be a trifle larger than the desired cut in the glass. To cut an ornamental band on a goblet, tumbler, or bottle, the work should be rotated slowly about 2 in. below the funnel tube. The turning, of course, may be done by hand, but this is tedious, and clockwork can be used. One device has a suitably mounted spindle, with a block of wood or a large cork on one end to fit snugly in the tumbler, so as to support it. Fixed on the spindle at half its length is a drum formed by a large spool, around which is wound a cord whose other end connects with a fixed double pulley and a movable double pulley, to which the actuating weight is attached. Pierced plates of metal or wood may replace the pulleys, but the friction will be increased, and there will be more wear on the cord. A small fishing line answers as the cord. The flow of emery may be cut off by a small cork in the funnel attached to a string. The spindle is cranked for rewinding the cord round the drum, the work of the emery continuing during the rewinding.

Asphalt Pavement: Advantages and Disadvantages.—Apart from its use as a paving material, asphalt was used thousands of years age as a cementing substance in building operations carried on by the earliest Asiatic races. No record exists of its use for paving until about the beginning of the present century, although in 1721 a small volume was published which described very fully the asphalt obtained from the mines of Val de Travers, near Neuchâtel, in Switzerland, and recommended its use as a paving material. It was adopted in the streets of Paris early in the present century, and its use was extended to England in 1836, since when it has been employed in a gradually increasing degree, until, at the present time, there are many miles of London streets paved with asphalt. In the districts of Westminster and St. James's some nine or ten miles have been laid; but it is on the Continent, particularly in Berlin, Vienna, and Paris, that the largest use has been made of this class of pavement. Asphalt is in many respects an excellent paving material, especially for streets and large spaces in the superior parts of cities, where the traffic, consisting mostly of carriages and cabs, is not heavy, and where cleanliness and a good appearance are of importance. The smoothness of its surface and its freedom from joints make it easy for travelling over. There is no joiting of the vehicles, consequently very little noise; indeed, the greater part of the noise is contributed by the feet of the horses. Its even surface makes it pleasant in appearance, and

tion of a suitable clay. The clay used for tiles should be tough and plastic, rich in silica and alumina, and containing the least possible quantity of iron, magnesta, etc. It should be thoroughly weathered—that is, instead of taking the clay from the beak where it is quarried direct to the grinding pans, it must be placed in heaps and exposed for some time to the action of the weather. Chemical action induced by atmospheric influences improves the quality of the clay by eliminating injurious substances, while the frost disintegrates and purifies it, making it easier to grind, and thus increasing the capacity of the grinding pans and lessening the wear and tear of the machinery. After proper grinding, and mixing with sufficient water to make a stiff plastic mess, the clay is placed in a heap in a cool place to "sweat" for two or three days, when it may he said to be ready for use. The prepared clay is then taken to a borizontal steam press, or "stupid" (Fig. 1), as it is generally called, and undergoes the first process of tile making. This is not the only type of machine used for work of this sort, and the same representative machines, and in general use. A die A (Fig. 1) is clamped on to one end of the machine, and a box B, into which the clay is thrown, le attached to the other end. Steam pressure is then applied to the piston c, which foroes the clay through the die, as shown in the illustration. The die simply consists of two pieces of iron (Fig. 2), and is made in two pieces so that the size of the aperture may be regulated. The



its imperviousness to water prevents it from absorbing noxious liquids, and giving off evil smells. It can be brought to a high state of cleanliness provided a good supply of water is available. In the matter of facility of repair, it is said to be rather better even than woodpaving, as the portion to be repaired can be cut on neatly and cleanly to the exact extent required. Whilst asphalt has many good qualities, it also has corresponding disadvantages. Thus, the smoothness which conduces to ease of traction makes asphalt unsuitable for localities where heavy loads have to be drawn, and where in consequence a good foothold for the horses is required; this slipperiness also prevents the use of asphalt on gradients such as would be possible with stone pavements. Asphalt is very slipper; when slightly wet unless kept quite clean, and this necessitates a large expenditure of water. Sanding and gravelling have also to be resorted to at times as a preventive of accidents. Another minor objection is that, when laid alongside tram lines, a place where there is apt to be great wear and tear on the pavement, asphalt wears away, or at any rate becomes compressed below the general surface very quickly.

Manufacture of Roofing Tiles, etc.—Roofing tiles.

Manufacture of Roofing Tiles, etc.—Roofing tiles, ridging, quarries or floor tiles, coping, moulded bricks, etc., are generally classed as "machine stuff," as distinct from terra-cotta, the latter term being usually applied to hand-made work only. An important feature in the production of this class of goods is the sclec-

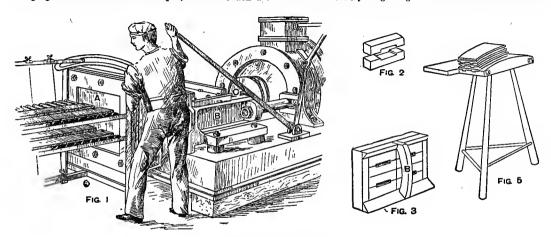
continuous passing of olay tends to wear away the metal, thus increasing the size of the opening and, as a consequence, the thickness of the tile. To obviate this, the die is made in two parts, so that when it shows signs of wear the opening is reduced to its proper size by planing off one face of the iron. Fig. 3 shows the back elevation of a die so arranged that four strips of clay may be made at the same time. To prevent a tendency to too great a pressure of clay against the inner corners of the apertures, a piece of wood p (Fig. 3) is placed down the centre of the die. The strips of clay as they issue from the die are run along on rollers (Fig. 1), and out by means of wires into proper lengths, At this stage the tile is merely a flat slab or bat of clay, the nibs on which the tile is hung on the roof battens and the holes for the nalls having yet to be made. This operation is done on another machine, which is shown at Fig. 4. The tile is placed in the box A, and the heavy ring B, working on a thread, on being swung round drops the plate c on the tile, pricking out the holes and raising the nibs. When discharged from the press, the tiles are stacked in piles or burns of about sixty, and allowed to become slightly stiff before receiving the pitch or slight curve (which is given them on a wooden block or horse) that enables them to lie flat one over the other when put on the roof. This horse consists of a slightly convex piece of wood (Fig. 5) fixed to a stand. The tiles are picked up—six at a time—laid on the horse, and squeezed into the required curve by means of a concave piece of wood

shaped to fit the back of the horse. The tile is now finished, and is set on the floor on its edge to become thoroughly dry before it is put into the kiln. The clay for hand-made tiles is tempered till it is much softer than that used for files made by the stupid. The mould is simply a cast-iron or wooden frame (Fig. 6), which is placed on a block of wood firmly fixed to a bench, sand or clay dust being freely sprinkled over the mould so that the clay may not stick to it. The workman then drops a square lump of clay over the mould and cuts off the superfluous clay with a piece of wire attached to a bow (Fig. 7). A piece of smooth wood called a plane, dipped into water and drawn over the mould, completes the making of the bat, which becomes a tile after passing through the press shown in Fig. 4. Quarries or flooring tiles are generally made in three sizes, 4 in., 6 in., and 9 in., the same machine and very nearly the same process being adopted for their manufacture as is used for roofing tiles. The bats or blank squares of clay are made in the stupid, and when quite stiff are stamped and finished in the press shown at Fig. 4. Special care, however, is taken to see that the press dies are in good condition and fit accurately, otherwise the edges of the illes will be fringed and rough, and the quality and value-of the tile will be depreciated. The face of the bat should be clean, smooth, and without dents before being pressed. Careful attention to details of this kind saves a great deal of extra work in polishing and facing. The tiles are then stacked up face to face in piles of twenty to dry. Ridging is also made in the stupid, but a wooden die

arrive at the weight by using the weight of a similar launch as a comparison, by the following method: The size of the launch is denoted by the product of the length, depth, and breadth moulded, and for existing launches the weight of hull is found to be a certain proportion of this number, the proportion varying as the style of the launch varies in weight, thus:— $\underline{L \times B \times D \times Coefficient} = Weight.$

The weight of the hull is taken in tons. The coefficients are tabulated for every launch, and when the weight of any new launch is required, the coefficient obtained from a similar existing launch is inserted in the formula and the weight is then found by simple arithmetic. The weight thus obtained is the net weight of the hull, without anchors and chains, coal, water, or machinery; and the outfit should be proportionate in all boats.

Incandescent Gas Burner.—The incandescent gas burner consists essentially of two portions, the mantle and the actual burner. There are now many modifications in the details, but the following description of the first successful type of incandescent burner will serve to explain the general principles of the system. The mantle, which was of a coulcal shape, was originally made of cotton which had been dipped in a solution of the rare earths thoria and cerium, in the proportion of about 98 per cent. of thoria to 2 per cent. of cerium. On burning away the cotton, a skeleton of the rare earths there are earths thorial to 2 per cent. On the cartha remained, which, on being highly heated, gave out an intensely bright light. The mantles were about



Making Roofing Tiles, etc.

lined with moleskin (Fig. 9) is used instead of a metal die. This die is clamped on to the mouth of the press, and when the machine is set in motion the ridging appears in a continuous strip. The ridging, however, is not run on rollers as in the case of roofing tiles, but, on account of the softness of the clay, is slid on to a saddle made to the same pitch or angle as the die. As acon as each length is cut, it is carried away on the aaddle, and placed on its edge on the floor to dry (Fig. 9). When the till is stiff enough to handle, a wooden box containing the design is placed over it, as in Fig. 10, the exposed parts being cut out with a knife. Wall coping is produced in the same way as ridging, and by the same machinery, the only point necessary to note being the way in which the coping is made hollow, and a back view of a die (Fig. 11) shows how this is done. The part A is suspended in the centre by a plece of iron, and as the iron projects some distance, the clay closes up before it reaches the die, thus leaving the block A to form the required hollow.

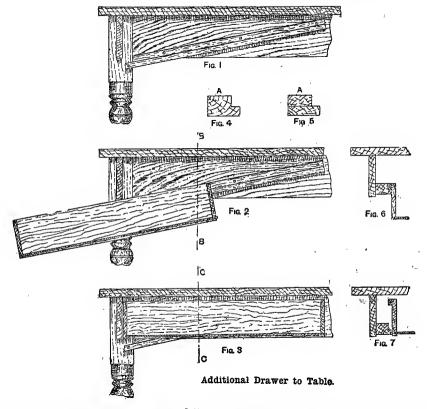
Determining Weight of Hull of Launch.—The weight of the hull of a proposed launch may be estimated in two ways. One is direct calculation of each portion of the structure, beginning with the skin, timbers, thwarts, keel, stem and stern-post, and bolts, and going over the whole boat in this way. There are a large number of items, however, that cannot be calculated accurately, such as brass fittings, cement, putty, paint, and varnish, floor boards, etc., and such weights can only be accurately estimated by comparison with existing launches. This method is very laborious, and unless very carefully and exactly performed by a skilled person, will give incorrect results. The best way is to

3 in. long and l in. in diameter at their lower end, which was cylindrical, but at the top they were drawn together to a diameter of about \$\frac{1}{2}\$ in., thus making the shape of the mantile conical. Across the upper end of the mantile a thick loop of the material was stretched; this supported the manile when in use on the fork of a thin fireclay prop, which passed up the long axis of the mantile and fitted into a cavity in the central conical-headed rod of the burner. Through the space between this central cap and the external tube of the burner the mixture of gas and air passed, a plece of wire gauze being stretched across the space. The burner resembled an ordinary Bunsen, but it was provided with the previously mentioned gauze and a amall plate fitting on the outside of the tube above the air ports, in order to diminish as far as possible the risk of "lighting back." A chimney, 2 in. in diameter externally and about 8 in. long, fitted over the mantile and upper end of the burner. When the gas was lighted, the flame filled the body of the mantle and produced incandescence on its surface. The mantle was a very fragile body, and consequently required great care in handling. For safety in transport, the mantles were dipped in a stiffening solution, generally colledion, which gave them extra toughness. After the mantle was in position on the prop, but before the gas was lighted, this stiffening material was burnt off by the application of a spirit torch, which does not deposit carbon on the mantle. 3 in, long and 1 in, in dlameter at their lower end, which

Detecting Resin in Oil.—One method is to shake a drop of the oil with one cubic centimetre of acetic acid and then add a drop of concentrated sulphuric acid. If resin is present, an intensely purple red colour appears, but fades after a short time.

Fitting Additional Drawer to Table.—An extra drawer in a table is frequently a very desirable acquisition, but in ordinary circumstances, although the space is available, the necessary structural alterations to the table are so serious that the work cannot be undertaken lightly. The method here described and illustrated does not possess this disadvantage; besides, the extra drawers can be removed at any future time without showing any disfigurement. The essential feature of the fitment is that the drawer passes in and out under the existing rail of the table instead of cutting through it, the runners being fixed sloping inside the rails (see Figs. 1 and 2). Of course, there are a few cases where this inclined condition would be wholly unsuitable. When the drawer has been pushed in, the front end is raised behind the rail of the table until the drawer is raised behind the rail of the table on the drawer is some simple device, which may take the form of a button or bolt; in any case, the fastening must be strong, as

with a cement, and the appearance of rivets on a prized piece of pottery will then be avoided. Several good cements may be made at home. The combination of shellac and rectified spirit known as Chinese cement is a very strong medium, and is made by dissolving \$\frac{1}{2}\$ lb. of the best pale orange shellac in 3 oz. of atrong spirit. The shellac should be pounded up fine and placed in a stoppered or corked bottle with the spirit, in a warm place, and the mixture should not be used until the shellac has become thoroughly dissolved. The real Chinese cement, however, as made by Chinamen, is produced by pounding glass to a very fine powder, then sieving it through silk, and afterwards mixing and grinding it with albumen. Ornaments repaired with this medium (providing beat is not applied) will not readily separate at the joint. White-lead will resist boiling water, and make an exceptionally strong repair if it is allowed to set before the article is brought into use; but it will take several weeks to harden properly,



a large proportion of the weight of the drawer and its contents falls on it. When thus closed, the drawer is out of sight, and its privacy can be enhanced, if desired, by arranging the fastening in a secret manner. The runners can either be made solid by rebating a piece of stuff as in Fig. 4, or can be formed by screwing two plain pieces together as in Fig. 5, but the top surfaces a (Figs. 4 and 5) must be sufficiently wide to allow the drawer to pass between the legs of the table. Strips, which fit in the rebates of the runners, are screwed on each side of the drawer at the upper edge, as shown in Figs. 6 and 7, which are sections taken respectively at B (Fig. 2) and cc (Fig. 3). The screws in the runners and strips must be well sunk to avoid trouble in the running of the drawer. A saving of labour can also be effected in making the drawer, because there is no need for the front to lap over the sides, as is usually pearance.

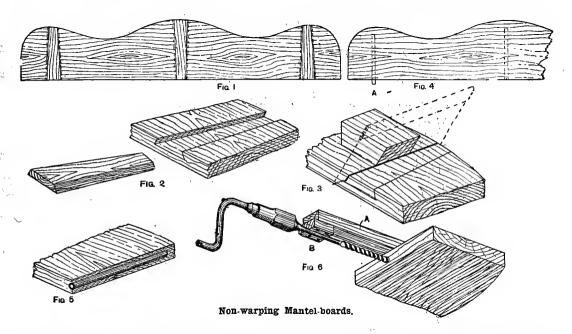
Cement for China and Glass.—In mending china it is questionable whether anything short of rivets should be used, for repairs carried out with the aid of cement are always more or less in danger of falling to pieces with ordinary usage. Of course china or glass that is rarely handled may sometimes be suitably repaired

and should always be used carefully, as traces of it are difficult to remove when allowed to harden on an exposed part. Where ornaments only are concerned, probably no cement is cleaner, stronger, more suitable, or more easily applied than isinglass dissolved in acetic acid. The great drawback of this is that it will not stand hot water. It should be evenly applied to the broken edges with a camel-hair brush, and sets hard in twelve or fourteen hours. The way in which the eement is used, rather than the kind of cement employed, is the important element in making a strong joint. Many people are afraid to heat delicate chins and glass ornaments sufficiently. The parts should be heated in the oven, as the cement commences to harden immediately it comes in contact with cold materials, and therefore produces a "set" layer between the broken parts. If possible, the article joined should be placed in some cool apartment where it is not likely to be shaken or upset. Always undertake the repair as early as possible after the article is broken, as then the edges are not in any way damaged, and a close joint results. Shellac itself makes an extremely strong joint if the broken parts are aufficiently heated to inse it when applied, but, unfortunately, it leaves a very noticeable dark line on white china.

Preventing Mantel-boards Warping.—The accompanying figures illustrate two methods of constructing mantel-boards so as to prevent them warping. The first method, illustrated at Figs. 1 and 2, is by means of dovetalled keys, the shelf being grooved out as shown at Fig. 2. A simple method of cutting the sides of all the grooves at one angle is to have a piece of wood about 3 in. by 2 in. with one end cut to the angle required; then the side of the saw may be kept to this slope, as indicated at Fig. 3. After the superfluous wood is removed, the bottom of the groove should be made even in depth by a grooving plane, and a router or old woman's tooth will be found very useful for this purpose. Then, when making the keys, the bevels can be set to the angle of the piece of wood against which the saw rested, and can be applied to the edges of the keys when planing them. The keys may be made of hardwood if desired, and finished flush with the under side of the shelf, or they may be thicker and allowed to project, this method being rather stronger. The keys must fit accurately, and must not be driven in too tight, or they will bend the shelf, making it hollow in its length. They can be glued in position. In the second method, illustrated at Figs. 4, 5, and 6, the board is planed true and shaped, and is then bored nearly through, so as to receive three gas pipes as indicated at Fig. 4. With

accurate will the estimate be. Naval architects and Isunoh designers use the Admiratly coefficients. When these first came into use, the speeds of steamships were so low that wave-making resistance was a negligible quantity, and a formula based on wetted surface with the frictional resistance varying as the square of the speed gave good results. The high speeds now common have altered that. The Admiratly displacement coefficient is the one which is used with most success in this and all ether countries except France, where the Admiratly mid-section coefficient is used with considerable skill by the French, who are quite aware of its defects. It is much too unreliable to be used in launch work. The formulæ to determine the Admiratly coefficient of performance are: Let D = displacement in tons, V = speed in knots, P = the indicated horse-power,

 $\mathbf{C}=$ the Admiralty coefficient. Then $\mathbf{C}=\frac{\mathbf{D}^{\frac{2}{4}}}{2}$ $P = \frac{D^{\frac{2}{3}} \times V}{C}; \quad V = \sqrt[3]{\frac{P \times C}{D^{\frac{2}{3}}}}; \quad \text{and} \quad D = \sqrt{\frac{P \times C}{V^{3}}}.$ These formulæ may be taken to apply approximately to launches which are not similar,



care, in a shelf in thick, a piece of gas pipe in in diameter, outside, can he inserted. A simple means of making the auger bit bore truly is illustrated at Fig. 6. At one end of a piece of wood about lin in square and lift. 6 in. long, fix a block. In this make a groove with the gouge so that the upper part of the bit fits in the groove and the point of the bit is in the centre of the thickness of the shelf, the bit is quite parallel to the under surface of the longer piece of wood A (Fig. 6). Thus when boring, by pressing with the left hand on this piece, it will travel across the upper surface of the shelf, and by keeping the bit against the block E. (Fig. 6) it will work bruly through the thickness. The most suitable material for mantel-beards is pine; this should be very dry, otherwise it will warp and twist. and twist.

Determining Power Required to Drive Launches.

—All formulæ designed to determine the power required to drive a vessel at a certain speed must be used in conjunction with exact speed and power trial data. Particulars of known launches concerning displacement and weights are of great value to the designer, but date of speed and power ascertained from actual trial over the measured mile are of most value, and the coefficient used in the power formula must be obtained from a similar launch at a similar or corresponding speed. The closer the proposed launch and the launch from which the coefficient is to be taken agree, the more

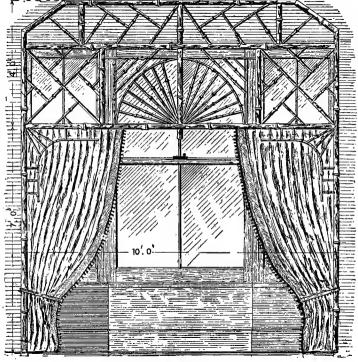
and whose efficiencies of propulsion differ. But the greater the similarity in bull, speed, and machinery, the greater will be the degree of accuracy with this method of approximating power or speed. It is a coincidence that the formula $\frac{D^{\frac{5}{3}} \times V^3}{P} = C$, which

was originally derived from an empirical expression of the supposed general law of resistance, happens to be one of the series which represents the true law of resistance as laid down by the late William Froude for ships of similar form when moving at speeds that are proportional to the square root of their linear dimensions. Weight has nothing to do with the resistance of a launch, but the weight of water displaced, and the method of displacing it, have to be seriously considered; and it is quite obvious that a full-bodded launch driven at maximum speed must have a different coefficient in any power formula from the fine-lined river launch which is steaming easily at the same speed.

Rust Joint for Pipes.—The following are the materials and preportions used in making a proper rust joint: Sal-ammoniac, I part by weight; flowers of sulphur, 2 parts; borings, pounded small, 80 to 100 parts. After well mixing, the mass is moistened, and the joint is caulked quite half full of yarn before the borings are put in. This makes a moderately quick-setting joint, and any endeavour to hasten it will probably result in cracked pipe sockets.

Bamboo Fitment for Bay Window.—The bamboo fitment shown in the accompanying illustration would be an ornamental addition to some styles of rooms; it is simple and straightforward to make, and the dimensions can be altered as the maker requires, but the lowest rail should be 7 ft. from the floor. Brown bamboo has the best effect, and is obtainable in 10-ft. and 14-ft. lengths by 2 in. thick; it will be necessary to join the ordinary lengths of 6 ft. 6 in. For the uprights, cut to 11 ft. two very straight bamboos that do not taper. These must be cut across at the nearest knot to a length of 4 ft. 6 in., measuring from the heavier or bottom end, the knot being marked across before cutting. The two 4-ft. 6-in. lengths then require filling at the cut end with a round wood plug 1 ft. long, leaving 6 in. out. The framework is all of 2-in. bamboo, and should be dowelled throughout. The top rail should be at the extreme ends of the uprights, the other 1 ft. below It, and the lowest rail 7 ft. from the floor. The ornamental design is all of 1-in. bamboo, worked in the usual way, and fixed with glue and fine panel pins, two being used for each end of each plece. Neat fitting is required,

visable to specify the order to be delivered in assorted colours. The colours in general use are red, blue, green, and yellow. These are termed plain colours, and, when only one colour prevails on a coil of wire covered spirally with cotton, the cotton is said to be lapped. Some vendors affect two colours on one wire, one being a ground colour of white, yellow, buff, or light hrown, the other red, blue, green, or black wound over spirally with spacing between the laps, so as to give it a spiral appearance. Wire thus covered is said to be whipped, and commands a higher price. Braided wires are usually covered in two colours. Some of the most effective are. Red and white, red and yellow, black and white, lack and white, red and green and amber. Any other shade may be generally obtained to order when ordering large quantities of several miles. Assorted colours on a large job are necessary as a means to distinguish one line from another, and branch lines from main lines. When exposed wires cannot be avoided, and it is necessary to run the lines along by a skirting, chairrail, or dado, a twin-line wire, with an outer coating to



Bamboo Fitment for Bay Window.

so that the taçade when finished shall be rigid and strong. The corner bends under the lowest rail are of 1½-in. bamboo, spindled on with ½-in. bamboo in the ordinary way. The two top corners must be cut away to clear the cornice moulding of the room, pieces being joined across as shown. The whole is fixed by being held with the top rail hard against the ceiling, and secured by 3½-in. screws through the uprights to the woodwork of the side windows of the bay, or if the bamboo is required still farther back from the window, by plugging the wall. The two 4-ft. 6-in. pieces of the uprights are then joined on with glue and secured in the same way. A curtain pole is put up, and three brackets are placed behind the lowest rail on the side to the window. This pole should be long enough to touch the two side walls, and 1½ in. thick, with twenty wood rings to match, no end fittings being required. On this are hung heavy Oriental curtains, 2 yd. wide, which may be draped to the sides and drawn close the centre at will. As a rule, in addition, the ordinary lace curtains are hung against the windows as usual; but in some cases these would not be required.

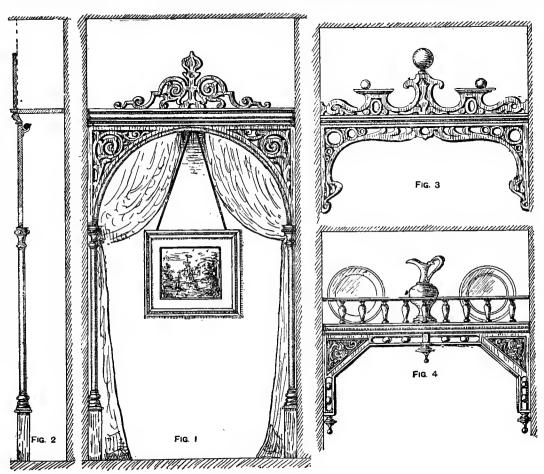
Electric Bell Wires.—The outer coating of electric

Electric Bell Wires.—The outer coating of electric bell wires is of coloured cotton. When ordering a mile of this wire from a dealer or manufacturer, it is admatch the paint or decoration, must be chosen. These twin wires are simply two insulated wires running side by side under one outer coating of coloured and parafined cotton. Their inner coatings should also be of two different colours, to distingush the outgoing from the incoming line. The insulation in the commoner class of twin wires is simply double-cotton-covered and paraffined; but this cannot be trusted in lines run so close to each other—hence rubber or compound insulation should be insisted upon in addition to double-cotton-covered and paraffined, although the price to be paid is higher for the better insulator. Twin wires twice the cost of single wires) are described as 2/18, 2/20, 2/22, etc., the second number being the gauge.

Causes of Sewing-machine Needles Breaking.—These include the needle plate hole being too small; edge of needle-plate hole too square (in this case bevel it with emery cloth or countersink it with the point of a drill); needle too small or striking the carrier; hook too late; shittle or hook worn; needle striking shuttle (in this case rub a little off the shuttle point with emery); shuttle carrier not guarding needle; roll presser or foot too close to needle; or needle-bar set too low. If the hook race is adjustable, see that the hook is not set too close to the needle.

Artistic Fitting for Room Recess.—In many older rooms the recesses are a little difficult to deal with, because shelves or other fitments have been built into the walls. The illustrations here given are intended to overcome a difficulty of this kind. For instance, in an upper room, which it is desired to make into a drawing-room, there may be a shelf which cannot be removed without danger to the walls, and it is suggested that its appearance may be remedied in the way here shown. Fig. 1 shows the recess, the shelf presumably being 1 ft. to 1 it. 6 in. from the celling. On the front of the shelf plant a moulding, say 2½ in. or 3 in. deep, and, say, of the section shown in Fig. 2. On the top of this moulding fix an ornamental centre place, which may be ½ in. or § in. thick and cut out in fretwork. Or, if preferred, a carved ornament of similar shape would

French-polished, or of red deal or any other light wood painted to match the other woodwork and decoration of the room. Fig. 3 shows an arrangement which would be very much less costly, and though not so complete, would yet give an artistic effect to an awkward shelf. The moulding shown is fixed as before described. The entre ornament above and the double ornament below the moulding may be cut out in fretwork, a small length of moulding being planted on the top of the two horns of the upper ornament, on which balls or vases should be fixed and a turned ball or vase on the centre point. Fig. 4 shows a similar arrangement, but instead of the top ornament a turned baluster is substituted with a pair of carved spandrils instead of fretwork, the ornament at the sides and the centre finishing off with a



Artistic Fitting for Room Recess.

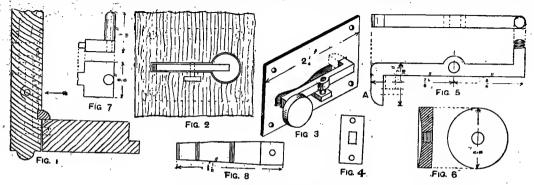
be suitable. On this shelf vases, plaques, or similar ornaments might be placed, as indicated in Fig. 4. Under this moulding place two arched pieces of wood, say ½ in. or § in. thick, and cut with the fretsaw. The under edge of the arch thus made may be rounded or bevelled, or a moulding may be planted on. The ends of the arches on each side are supported on turned pillars on a square base with moulded cap, about 1 ft. high. The pillars may be 1½ in. or 2 in. in diameter and the capitals and bases may be turned plain or carved. This fitment may be secured to the wall with plugs and plates in the usual manner. In the recess thus formed a picture or pictures may be hung according to the space at disposal, and a small cabinet or a lounge might be placed in the centre. To improve the general effect, a curtain rod may be fixed behind the arched portion, and a pair of lace or light art muslin curtains would look well. This arrangement would be made of walnut, mahogany, or any similar wood, and

turned knob. The curtain arrangement may be equally well adapted to these plans. The whole wood might be French-polished or painted or enamelled for each design, and the pillars may be square, round, or hexagonal. It is necessary that the new finish or paint harmonises with the rest of the room.

Wax Tapers.—For preparing wax tapers, special wick is wound around a drum, and then is made to pass into the melted wax under a hook placed at the hottom of the kettle containing the wax. The wax-coated wick passes through a draw-plate which gives it the desired diameter, and then winds around a second drum. A little tallow, resin, and turpentine is often added to the wax in order to give it greater ductility. Wax matches, also, which are generally of paraffin, are made with the draw-plate. They are afterwards cut to the proper length, and tipped with a paste of the igniting mixture.

Secret Fastening for Cupboard.—The spring catch for a cupboard shown in the accompanying illustrations will, if carefully made and neally fitted, be hard to detect, and the difficulty could be increased if the press button were moulded to represent a flower or other cruament repeated at intervals on the side of the case. The plan (Fig. 1) shows a portion of the door stile and side of the case, with the catch in dotted lines, and Fig. 2 is an interior elevation of part of the cupboard side, showing the catch in position, the position of the face-plate being indicated by dotted lines. The arrow in Fig. 1 explains how this view is obtained. Fig. 3 shows the spring catch complete as seen from inside. Fig. 4 is the striking plate for the door, and Figs. 5 to 8 show, full size, the various parts of the fastening. This consists of a brass bar of 1 in. square section, 18 in. long, with the ends turned right and left, one being filed round and threaded to receive a disc or finger button (Fig. 6). The other end is rounded on the outside to shut automatically when the door is closed. Near the middle of the bolt, which is swelled for strength, a 1 in. hole is drilled to receive the pivot shown in Fig. 7. The lug of this has a spur on one end, which is driven tightly into a hole in the face-plate, and riveted on the outside. At the opposite end a 1 in lole is drilled, and the piece of 1 in. wire forming the pivot is filed down to fit. A small steel spring (Fig. 8) is riveted to the face-plate behind the catch, and normally presses outwards the end of the bolt carrying the disc, a small piece of brass being fixed under the front end of the bolt to prevent the disc being projected too far. This piece should at first be made

naked arm and hand should be used instead of the spoon. Any scum and air bubbles which may rise to the surface are skimmed off. All this should be done briskly, though not hurriedly, or the plaster, if tresh, may set before it can be used. The ordinary practice is to make a waste mould in two distinct shells or layers, known as the inner and outer moulds, and it is destrable that the inner one should be coloured. What colouring matter is used is immaterial; ochre is often used, so also is common black ink, which slightly hardens the plaster. A mere tinge only is required—indeed, a deep shade might stain and injure the whiteness of the cast. The necessary quantity of water should be coloured before work is begun and poured into a second vessel to free it from sediment. Let it be presumed that a model of the ornamental keystone of an arch is to be cast. This is a simple affair, as the mould can be made in one piece only, whereas some models have to be moulded in two or more pieces. It is prepared by blowing water over in a fine spray, so as to improve the surface and cause the liquid plaster to flow more freely over it. Enough water to form pools in the hollows should not be put on, or the plaster will be softened and the mould made rotten in those places. A basin of coloured plaster being mixed of the consistency of cream, it is flung with the spoon or hand over the model, and forced into every hole and cranny; bellows are used for blowing it where it cannot be sent without them. Every part of the clay has to be covered to a depth of, say, in. While this inner shell of plaster is setting—which it should do in a few minutes—a mixture is made of clay and water as thick as puddle, and brushed over it. This film of clay



Secret Fastening for Cupboard.

rather too long, and when the catch is fitted in place can be filed off until the disc lies just flush with the face of the case. This stud has been omitted from the sketches for clearness, but its position is indicated by dottei lines in the plan portion of Fig. 5. All the parts should be rubbed with vaseline to ensure noiseless working, and in fitting the catch, after having marked its position accurately on the cutside of the case, bore the hole for the disc from that side, and then the position of the sinkings can be easily ascertained.

Making Cast from Clay Model.—Clay models can rarely be preserved; it is therefore usual to cast them in plaster-of-Paris by the process known as "waste moulding." By this process, the model is incrusted with plaster to form a mould, the clay is removed, and the mould is instead, filled with plaster. Afterwards the mould is broken away and destroyed, hence the name. Plaster-of-Paris is sold in three qualities—superfine, fine, and coarse. The first is little used except for facing delicate work—such as small medallions; the second is used for facing both moulds and oasts in ordinary work; of the last most of the thickness of the moulds is made, as well as the unseen parts of the casts themselves. The plaster is sprinkled with the hands into a vessel partly filled with water. Hard lumps reby this means detected and may be thrown aside, and, as the plaster is allowed to sink gradually, but few air bubbles are formed. When, instead of sinking, it begins to stand in heaps above the water, no more should be sprinkled in. Plaster only sets properly when mixed with a certain quantity of water, and by the above-described method it can be seen when the right proportions have been reached. The mixture is then well stirred together. For casting on a large scale, a pail will be most convenient to use; for smaller work, a basin. A spoon is put into the latter, and, by giving a circular motion to its bowl, without bringing it above the surface, the fluid is made to boil up. In a pail the

is to prevent the outer mould from adhering too closely to the inner one. Fine plaster should be used for the inner mould, but for the outer one coarse will suffice. It is mixed and flung over the inner shell in the same manner as before. It is usual to strengthen the outer mould with rods of iron so as to save plaster, and also to keep the mould from warping, which it is liable to do when it becomes heated in setting. Those who do much of this work keep by them a number of bars varying in length and thickness, and bent in different ways; but any odd pieces of iron will answer the purpose. When the outer mould is, say, ½ in. thick, the irons are laid upon it in such a way as will most add to its strength, and they are then embedded by pouring on more plaster. The mould altogether should not be less than ¾ in. thick. Plain, not coloured, water is used for mixing the plaster for the outer mould. Whenever a vessel has been emptied, it should be rinsed out before more plaster is mixed in it. In half an hour the mould will have set, and the clay can be removed from within it. When a model is moderately flat, and has not many undercuttings, the whole may he extracted in a single lump. This is done rather by persuasion than by force. By pushing the clay, it is not difficult to make some little opening between it and the plaster; water is poured into the opening, and the clay gently worked up and down. More water is poured in, and is induced gradually to spread over and soften the face of the model, which presently slipe out. Low reliefs may thus be extracted absolutely uninjured, so that a second or even a third mould may sometimes be taken from them; but when the relief is high, with projecting masses, the clay has to be dug out plecemeal. After removal of the clay, the mould is well washed with soap and cold water. As any rough treatment might injure its face, a soft sponge is best for doing this; in hollows where a sponge cannot be used, a soft brush may be substituted. Finally, the mould is swilled out by directin

is filled with liquid plaster, a mould must be dressed with grease, soft soap, or some similar substance is erroneous. Except in very coarse work, any such dressing would do nore harm than good. A cast will not adhere more closely than is desirable to a mould which is thoroughly saturated with water, though it will stick fast to one only slightly moistened—much faster, indeed, than to a dry one. After washing, it is well to fill the mould without unnecessary delay, for a fresh mould always chips off more satisfactorily than a stale one. The cast has first to be faced with fine plaster, which is mixed with plain water. It is, when ready, poured into the mould, which is gently rocked, so as to induce the liquid mixture to flow into and cover every part of it. Into crannies where it would not otherwise enter it can be blown with the bellows. The facing of fine plaster may perhaps he \(\frac{1}{2}\) in thick. Coarse plaster is then substituted, and continued to be poured in till the average thickness is \(\frac{2}{3}\) in. A cast similar to the one in hand will scarcely need strengthening; but, when necessary, strips of slate or rods of metal may be embedded. When the cast has had time to set, the mould is chipped away with a blunt chisel and mallet. The outer portion can be removed with a few strokes, and in a few pieces, for the film of clay between will cause it to leave the inner portion readily. Great care is needed in breaking away the inner shell. It is not desirable that it should leave too freely, or it may bring with it some of the projecting parts of the actual cast. It is safest to hold the chisel almost at right angles to the surface whilst at work. The colour of the inner mould—a lightish grey if ink has been used—renders it easily distinguishable from the pure white of the cast, so that there is no danger of driving the chisel into the latter by mistake. Any parts accidentally broken from the cast are stuck on with either liquid plaster or dissolved shellac.

**Usnal Weights of Sheet Lead for Various

Usual Weights of Sheet Lead for Various Purposes.—The weights of sheet lead are varied according to the class of work, and may be graded as follows:—

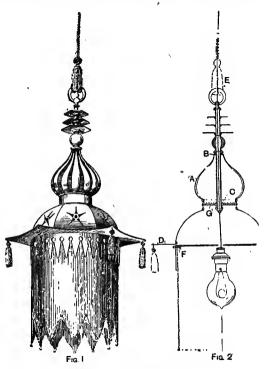
| | | | 1 | Pour | ıds pe | r sq . ft | |
|-----------------|-----|-----|-----|------|--------|---------------|--|
| Cistern bottoms | | | | 6 | 8 | 10 | |
| ,, sides | ••• | ••• | ••• | 5 | 7 | 8 | |
| Flats | ••• | | | 6 | 7 | 8 | |
| Gutters | ••• | ••• | ••• | 6 | 7 | 8 | |
| Valley Gutters | | ••• | | 6 | 7 | 8 | |
| Ridge | ••• | | | 5 | 6 | 7 | |
| Hips | ••• | ••• | | 5 | 6 | 7 | |
| Flashings | | | | 4 | 5 | 6 | |

Hips 5 6 7
Flashings 4 5 6

Distinguishing between Petersburg, Swedish, and American Yellow Deals, and Yellow and White Baltic Deals.—Russian deals generally come unmarked into the market, or only dry stamped or marked at their ends with the blow of a branding hammer such marks being also termed hard brands. In some cases where the goods are not branded, the second quality have a red mark across the ends, third being easily distinguished from second quality goods. The well-known Gromoff Petersburg deals are, however, marked with C. & Co., the initials of the shippers (Clarke & Company). Another good Petersburg brand is P. B. (Peter Belaieff) for hest and P. B. 2 for second quality. Swedish goods are never hammer-marked, but invariably branded with letters or devices stencilled on the ends in red paint, which makes it difficult to judge of their quality by inspection, as they are stacked in the timber-yards with their ends only showing. Some of the common fourth and fifth quality Swedish goods are left unmarked, but they may generally he distinguished from Russian shipments by the bluer colour of the sapwood. The first and second qualities in Swedish deals are classed together as "mixed," being scarcely ever sorted aeparately, after which we get third-down to fifth-quality goods. Deals of lower quality than third are nearly always shaky, or very full of defects of some kind. American goods are not branded, as a rule, though some houses use brands in imitation of the Baltic marks already described, but without following any definite rules. The qualities may however, very often be known by red marks. I., II., III., upon the sides or ends, but the qualities of American yellow deals are easily told by inspection, the custom in the London Docks being to stack them on their sides, so as to expose their faces to rolw, and allow of free ventilation. Baltic yellow deals are from the Pinus sylvestris or Northern pine. The colour of the wood is generally reddish yello

a silky lustre, and the timber contains a large number of very hard glassy knots from 1 in. downwards in diameter. The sap-wood is not distinguishable from

Moorish Lamp Pendant,—The accompanying design (Fig. 1) is for a pendant in the Moorish style that may be used to light up any odd corner or an alcove in an effective manner, and its construction is fairly simple. It may be made either in thin sheet brass and finished with dull gold lacquer, or in zinc and painted in various colours with enamel. A section is shown at Fig. 2. The vase-shaped portion A should be made in twelve separate pieces, each lightly beaten out with the hammer and soldered at the top B to a small metal plate which is screwed on to the main stem; at the bottom the pieces are all soldered to the thin metal ring c. The lower part of the fitting is hexagonal, as shown at Fig. 1, and is supported by the spider 6 (Fig. 2). At each of the six corners of the flat metal plate D should be hung a small crimson silk tassel,



Moorish Lamp Pendant,

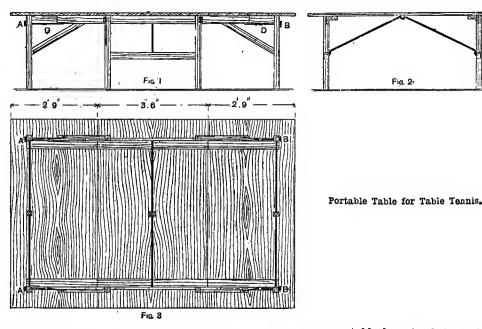
a larger one being hung at E as shown. Three screws F support a wire ring from which hangs the glass head fringe, this being obtainable in any desired colours. The screws also hold in position a round opal disc, which adds greatly to the general effect and also serves to reflect light. The diameter of the fringe should be about 7 in., and the rest of the lamp should be in proportion to this size.

Colophony or Resin—Resin is the residue left in the stills after the distillation of turpentine. It is contained in the state of solution in the natural turpentine or gum thus derived from several species of pines, and is simply separated as a by-product in the manufacture of the volatile oil or spirit of turpentine. Resin is usually imported in barrels, into which it was poured in the melted condition; it is therefore usually in very large masses, which, if of good quality, are pale amber coloured and quite transparent, but the common kinds are dark brown or nearly black. Resin is an oxidation product of turpentine, and it is a well-known fact that oil of turpentine on keeping gradually thickens or becomes fatity, and will further solidify after a time; this change is brought about by the absorption of oxygen and the formation of resin. Resin is easily melted; it is readily soluble in turpentine, alcohol, etc. Used alone, it forms very brittle varnishes.

Determining Magnifying Power of a Field-glass.—
A common method is to ascertain the focal length of the object glass, and divide that by the equivalent focus of the eyepiece. As, however, few opticians, and still fewer amateurs, would be able to measure these fooi with the accuracy required, another way is suggested. Paint on a black background a white vertical scale, with gradations I ft. long, and spaces between each I ft. long. Have six spaces, and let the bottom space he occupied by a circle 1 ft. in diameter, and, to be more accurate, subdivide the 1-ft. spaces into ten parts, alternate gradations being 3 in, and 6 in. long respectively. At a distance of 50 yd. from the scale, fix the field-glass on a telephone stand, with universal motion, or on a surveyor's ball-and-socket stand; look through the glass with one eye, and with the other observe the number of divisions and subdivisions the magnifying power sought.

Preparing Foundations for Wood-block Floors,— The ground beneath a wood-block floor must be absolutely firm and unyielding. The surplus earth from the foundation trenches should be evenly distributed over the whole surface, so that by exposure to rain before the building is covered in, and the constant mon practice of flooding the concrete with water to save another turning over should not be tolerated; satisfactory results can only be obtained by steady watering, even though this may entail an extra turning over to bring the mass to a proper consistence. When the concrete has become firm enough to walk upon, cement from ½ in. to ½ in. thick, and gauged 1 part of cement to 3 parts of good sharp sand thoroughly washed, is floated. Dots are first levelled, and screeds run about 9 it. apart, and as soon as the screeds have become steady the body of the floating is laid in and struck off level from the screeds with a long straightedge. No attempt should be made to finish the face with a hand float, or hollow places would result; as soon as a room is completed it should be barricaded, and, when the floating has firmly set, scaffold boards should be laid down so that the cemented surface may not be damaged by walking upon it. The laying of the blocks should be deferred as long as possible, in order that the cement may become thoroughly dry. The time taken in drying will depend upon the weather and the time of year, but in any case several weeks will be required.

Portable Table for Table Tennis.—Figs. 1 and 2 show elevation of a portable table tennis table which would be of simple construction. The whole can be readily



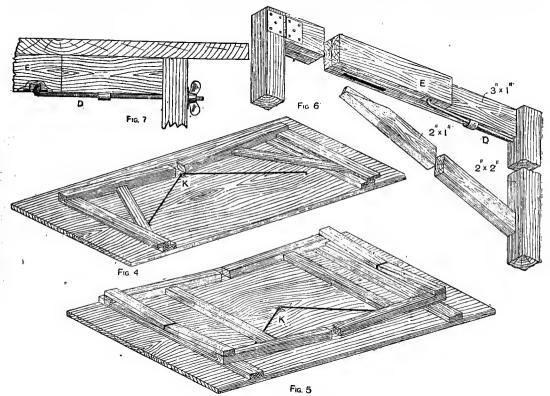
traffic of the workmen for a period of several months, the bottom will become thoroughly hardened and consolidated. When the ground is firm enough, the surface is levelled off at a depth below the floor level equivalent to the combined thickness of the gravel filling, the concrete bed, the cement floating, and the wood blocks, so that the face of the latter may finish at its proper level. On the levelled bottom a filling either of broken brick or of rough gravel is ladd, to a thickness of not less than 6 in, to 9 in.; if dry gravel is used, it should be well damped, and then rammed down to its proper level. Next comes the bed of concrete, which should be not less than 4 in. thick; and as it is necessary to bring this to a true face, pickets are driven in, in rows ahout 9 ft. apart, and levelled to each other so that their height above the gravel filling is equal to the thickness of the concrete. These pickets act as guides to which screeds can be laid, and when the concrete is filled in it can he struck off level from the screeds with a loft, straightedge. The concrete is gauged 5 to 1—that is, 5 parts of clean washed gravel to 1 part of cement; these proportions being carefully measured, and not merely approximated. The gravel must be really clean, and the gravel and cement thoroughly mixed together while in the dry state, the mass being surned over at least twice. The water is applied through a watering-pot or a hose fitted with a fine rose; water poured from a bucket or from a watering-can without a rose is so irregularly and unequally distributed that much of the cement is washed out and lost. The com-

separated or connected by loosening, but not taking off, four wing nuts A and B (Figs. 1 and 3), the hooked ends of the rods n (Fig. 1) being drawn out of the sockets in the rails, which, being hinged to the legs of the centre table, can be folded together. Thus the middle part can be used as a separate table, which, like the outer leaves, has the legs so arranged that the rails to which they are connected are hinged to the ledges of the top. Then, by moving the iron rods out of the eyes, which are screwed into the lower rails of the table, into the legs of the leaves, the pieces in each case can be folded down as shown at Figs. 4 and 5. The total length of the table is 9 ft., the breadth 6 ft., and the height 2 ft. 5 in. The top is made up of three leaves, each of which can be formed of three or more pine boards about 1 in thick. These should be jointed and glued, and a much stronger joh results if the joints are ploughed and a cross tongue is inserted as well as glueing. American white wood or hass wood, although a little more costly, would make a much better top, and could be obtained so that only one joint would be required in each of the outer leaves, the middle leaf needing only one joint. The leaves should be planed off true on the under side, and the ledges should be prepared and screwed on the under side, as in Figs. 3, 4, and 5, to prevent warping. Then the upper sides of the leaves should be planed off true and smooth. For the legs and rails being mortised and tenoned together with barefaced tenous.

The braces to hold the legs and rails of the leaves rigidly together are shown at Fig. 6. All these joints should be properly glued together, and if desired may be further secured by inserting wood pins. Each top rail of the legs should be connected to each ledge by two 2-in. black flap hinges, these being fixed so that when the legs are raised in a vertical position the top rests on the rails. The iron the rods should be of 1-in. round iron, one end being forged and connected to an eye plate, as shown at K (Figs. 4 and 5), while the other end is hent so as to clip into an eye screwed into the rails of the centre table, or into the legs of the leaves. Next the four movable rails should be prepared and connected hy hackflap hinges to the legs of the centre table, as shown in Fig. 6. The irons marked D (Figs. 6 and 7) may he made of 1-in. round iron, one end heing turned up so as to fit into an iron socket left into the rail D, the other end being threaded for a wing nut. The movable rails keep the leaves flush.

Manufacture of Sodium Peroxide.—This powerful bleaching agent, when obtained by the conversion of metalite sodium, is accomplished easily by

ary for contrast; or two warm colours, with one cold colour as a contrast. Colours of the same hue may be altered in value by the addition of white to one of them, or one may be altered by adding to it its complementary or contrast colour. Experience shows that a colour may be deepened in appearance by heing contrasted with white, or may be lightened by the contiguity of black. Blue makes yellow look brighter and fuller of colour. Yellow causes hiue to look purer and tess luminous. Blue and yeltow stand next to white and hlack as examples of contrast. Blue on a hlack ground appears to add orange to the black, thus making the latter less hrilliant. As Chevreul says, "Each hecomes tinged with the complementary of the other." On the other hand, orange on a black ground appears to add hlue to the black, so that it appears of a deeper black. When carmine is either mixed with or placed on a black, it hecomes purplish in tone. Black placed upon white causes the white to tend towards a blutsh grey; whilst upon yellow it appears tinged with olive green. The luminous colours, as yellow, orange, red, and, generally speaking, the light tones of all colours, are improved by the presence of black, but blue is an exception. White



Portable Table for Table Tennis.

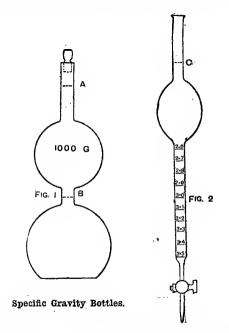
hurning it in an excess of dry air, free from carbon dioxide, in a suitable externally fired retort. On removal from the retort, and whilst still hot, it is ground to a fine powder, and, as it deteriorates quickly on exposure to air, it is packed at once and shipped in airtight cans. It must be handled with great care, as it is very powerful. Commercial sodium peroxide contains about 18 per cent. of available oxygen when fresh.

Colour Combination as Applied to House Painting.—In devising a scheme of colour for a huilding or part of a building, several methods may he adopted. A primary may be taken, and used in small quantities with all the hues into which the primarles enter; for example, yellow may he used with all the hues etween orange and hiue for a wall surface; or one primary may be selected, and two secondaries, as red, green, orange; or the broken thus or tertlaries may be used, say, claret, russet, and olive green. In a scheme the colours should he gently graded one into the other. An alternative is to select one colour for the ground, and use darker or lighter tones of the same colour, with a complement-

grounds do not suit luminous colours. If white is mixed with a pigment, it weakens its intensity; thus vermition becomes a pink. It is best, therefore, to lighten it with chrome yellow, as this will not destroy its character. The hrowns are also deprived of their tone by white. Raw sienna is a useful pigment to prevent chalkiness in a scheme of colour. Generally speaking, black causes colours to look brighter, while white lowers their luminosity.

Commercial Varieties of Mica.—These include the white or potash mica (muscovite), yellow or magnesia mica (phlogopite), and hlack or iron mica (biotite), hut there are no hard and fast lines, and they shade into-each other. The last is the commonest, and generally is excellent for electrical purposes when not marred by specks and streaks, which absolutely destroy its usefulness; it is of no use for glazing and grinding up. The yellow mica (which includes the "amber mica" of the trade) is fairly well adapted and much used for glazing, for which potash mica is particularly suited, though it is too hard and brittle for most electrical uses.

Ascertaining Specific Gravity of Portland Cement.—The specific gravity of a substance is the proportion which its weight bears to that of an equal volume of some other substance which is adopted as the standard of comparison. In the case of solids the etandard substance adopted is pure water; and since the weight of a given bulk of water varies somewhat with its temperature, and also with the state of the air, the temperature is taken at 62° F., and the latter at 30 in. at sea level. On the Continent the temperature is taken when water is at its greatest density, that is, at 39:2° F. As these figures are somewhat difficult to remember, and as absolute scientific accuracy is difficult of attsinment, the following are sufficiently approximate for all practical purposes, and are easy to bear in mind. The specific gravity of any substance in the centimetre-gramme, second (or Continental) system is its weight in grammes per cubic cost in England the weight in ounces per cubic foot + 1,000 = the specific gravity; thus the weight of water per cubic foot is 1,000 oz., and its specific gravity is 19:26; a cubic foot of cast-iron weighs from 6,992 oz. to 7,590 oz., and its specific gravity is from 6.992 oz. to 7,590 oz., and its specific gravity is from 6.992 oz. to 7,590 oz., and its



difficult, if not impossible, to obtain a cubic foot for the purpose of ascertaining the number of ounces, the specific gravity is obtained as follows. Weigh any available piece of it first in the air, w, then in water, w, and the specific gravity = \frac{w}{w} - w \text{ When the solid takes the form of a powder, like Portland cement, such a method either of calculation or of weighing is impossible. A cubic foot of Portland cement at 112 lb. per bushel would weigh 90 lb., or 1,440 oz. per cubic foot, and should have a specific gravity of 1'44; whereas the ascertained specific gravity of 1'44; whereas the ascertained specific gravity is 5'127. This is accounted for by the presence of a considerable quantity of atmospheric air in the interstices between the particles of cement. The three following methods of ascertaining the specific gravity of comment are practical, approximately accurate, and comparatively easy to carry out: The first method is that suggested by Mr. T. W. Keates, F.C.S. The apparatus consists of a balance capable of determining weights to a grain, and a double bulb bottle similar to that shown in Fig. 1. The exact capacity of the lower bulb is of no importance, but it is desirable that it should somewhat exceed the capacity of the upper bulb. On the neck between the bulbs is a file-mark B, and on the neck of the upper bulb between the marks A and B must be accurately determined, and may conveniently be either 500 or 1,000 grains of water at 62° F. the latter size being preferable, to obviate mathematical calculations. As Portland cement is to some slight extent soluble in

either petroleum or turpentine should be used. The capacity, then, between the marks B and A must be equal to 1,000 grains of the liquid used, and after the specific gravity of the cement, in proportion to the specific gravity of the cement, in proportion to the specific gravity of the cement, in proportion to the sum is all that is necessary to ascertain its specific gravity in proportion to water. The mode of procedure is this: Fill the bottle with turpentine (or whatever other entitle liquid may be chosen) to the mark B, and ascertain its weight exactly. Weigh in a scale exactly 5,500 grains of cement, and drop it carefully and gradually into the bottle until the surface of the liquid rises from B to A; weigh carefully the remainder of the cement, and the difference will represent exactly the weight of the material so added, and will give, divided by 1,000, the actual specific gravity. The only precautions to be observed are: (i) That the air, which is apt to cling to the particles of the cement when dropped into the liquid, is carefully removed by shaking or stirring; and (2) that, if a very volatile liquid be used, the bottle chould be stoppered or corked to prevent evaporation. Another method is suggested by Mr. H. K. Bamber, F. I.C., who prefers to use water, as he found that turpentine expands rapidly with every increase of temperature. Huses a plench. The contractive with water at 60° F. from a cistern, wheed dry and clean outside, and corked and carefully weighed. About two thirds of the water is then poured out, and 100 grains of cement, accurately weighed, are then poured in through a dry glass funnel, the bottle is corked, and the whole well shaken for three or four minutes, to prevent setting and to disengage the air. The bottle is then again accurately which water from the same cistern, where the temperature will not have changed, and the bottle wight 100 grains of cement, accurately weighed, are then poured in through a dry glass funnel, the bottle is corked, and the whole well shaken for three

Cause of Smell from Heating Apparatus.—The unpleasant smell from heating apparatus when it is employed for the first time after a long rest is well known; the smell exists even if the temperature does not reach the boiling-point of water. It has frequently been asserted that the smell was due to a dry distillation of the dust particles, though this could take place only at temperatures greatly exceeding those likely to arise in the usual forms of low-pressure steam apparatus, or those depending on the circulation of hot water. In order to arrive at the real cause, exhaustive examinations were made in Germany, and it was shown that the fine dust consisted largely, and in some cases wholly, of very minutely divided horsedung. Moreover, the dust found in the cold pipes always contained a large proportion of moisture, and was rich in micro-organisms. When the apparatus is first set in operation the warmth induces these organisms to vegetate in great numbers, and results in setting free large volumes of ammonia. This

gives rise to the unpleasant smell, and has an irritating effect on the mucous membrane. In order to avoid the smells, all that is needed is thoroughly to clean the pipes and coils before the fires are lighted.

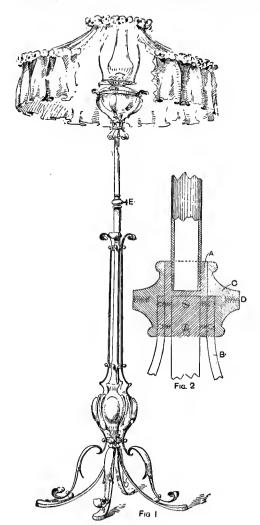
Variation of Electric Resistance at Low Temperatures.—This is very great in the case of the pure metals, while with alloys it is usually less. An experiment that shows this is to connect a small coil of copper wire forming part of an electric circuit with a mirror galvanometer; when the coil is plunged in liquid air the current increases greatly, and in fact its value at - 190° C. is as much as six times that at zero. This is shown more clearly by a group of incandescent lamps which have a resistance-coil in series, and thus burn at low redness; when the coil is plunged in liquid air the lamps burn with a bright light. According to recent researches of Dewar, the resistance diminishes gradually with the temperature, but on arriving at the resistance at the absolute zero should be still appreciable. Dewar has shown that, at the bolling temperature of liquid hydrogen, the resistance of copper becomes the total control the summer of the value at normal temperature, which is somewhere about 16° C.

Colour Hues and Tones.—The essential difference between hues and tones of colour is not by any means clearly understood. Hues are the different modifications which any colour may undergo by the addition of another colour, while tones are the varying strengths of a colour resulting from the addition of white or any reducing medium, varnish, etc. Thus, if a little violet take colour be added to a dark bronze blue it will alter its character or its hue completely. The addition of crimson lake to vermillon gives the latter a crimson hue. A grey made by mixing black and white is capable of receiving aimost any variety of modifications—that is, hues—by the addition of suitable colours. What is known as simultaneous contrast with reference to coloured surfaces, however produced, has invariably a considerable influence on colour as it appears to the eye, accentuating or minimising the effect of each colour according to its surroundings. Thus if a strong red and equally powerful green are printed side by side both colours will be enhanced, and the same applies to dark blue and dark yellow. Now vary the contrasts, and the results will be that when blue or yellow are printed alongside either green or red no colour shows to advantage, and all are often seriously depreciated in hue.

Elastic Moulds for Plaster Casts.—The inconvenient rigidity of plaster moulds, which will not accommodate themselves to any undercutting, led to the invention of the elastic mould, which may be pulled over any moderate projection, and, if necessary, a clean cut may be made in it, yet its elasticity will bring it back to its original shape. Glue was the material first used, but this has since been superseded by gelatine. The gelatine used should be of a good quality—such as is sold at from 1s. 6d. to 2s. per pound. It is soaked in cold water for four hours, and then, without more water being added, is heated in a glue-pot. On a larger scale, a vessel arranged on the same principle as the glue-pot is contrived. When the gelatine is dissolved, a few drops of carbolic acid are added to prevent mouldiness. White heeswax or parsfin wax (ready melted), in the proportion of from \(\frac{1}{2}\) oz. to \(\frac{1}{2}\) oz. to the pound of gelatine, is also well stirred in. Many objects are merely colled before moulding, but, if the object be plaster, it is brushed over two or three times with shellac dissolved in methylated spirit; and a sufficient enclosure is formed round it to keep the gelatine within bounds. The mould is poured on as a thickish syrup, neither boiling nor cool. but just as hot as the finger will bear with comfort. Every part of the object is covered to a depth of, say, \(\frac{3}{2}\) in. About twelve hours is needed to stiffen the mould, but placing it in a cool draught hastens the setting. An outer case of plaster to give support to the gelatine is generally desirable. Before making it, instead of the clay water used in waste moulding, off is brushed over the inner mould. A little powdered alum, say 1 cz. to the gallon, is dissolved in the water used for mixing the plaster. Alum hardens plaster; it also lessens its tendency to grow hot whilst setting, and this latter is the chief reason for using it in connection with elastic moulds. Heat melts and spofis the surface of the gelatine, and must be gua

mould can be taken from soft as well as from hard substances. In ornamental work they are not infrequently taken direct from the clay model. In such cases a soft camel-hair brush is used for laying on the dressings of shellac.

Standard Oil-lamp. — Fig. 1 is an effective design for a floor standard for an oil-lamp. It is suitable for making either in wrought-fron or brass, and the ornamental shield-work, etc., is intended to be made of repoussé sheet metal. Fig. 2 shows the method of fixing the four feet to the main stem of the standard. A (Fig. 2) is a turned piece of metal sunk on four sides to a depth corresponding to the thickness of the metal of which the feet are made. To this piece the feet B are screwed, as shown, and it is also tapped 1 in. at the



Standard Oil Lamp.

top to take the stem of the standard. To conceal these joints, the turned collar c is slipped over, this being drilled and tapped to take screws D, which hold the shield-work. The standard is intended to be adjustable to various heights, so that the stem is in two parts, the upper sliding into the lower, and being held in position by the thumbscrew E (Fig. 1). The height from the floor to the thumbscrew should be about 3 ft. 3 in., sufficient length of sliding tube being used to allow of raising the lamp another 2 ft. A full-size working drawing should be made before setting to work, all the rest of the fitting being kept in proportion to the dimensions of the lamp illustrated above.

Painting Portland Cement Work.—Portland cement work to be painted should be thoroughly hard and dry. It is advisable to let the work stand for a year before oil paints are applied. First brush over the surface with dilute sulphuric acid—l part of acid to 100 parts of water—and allow this to dry before painting. A preparatory costing for oil paint is a solution of common water glass in 3 or 4 parts of water. Two applications, followed by a washing with water, and another application of water glass, will be effective.

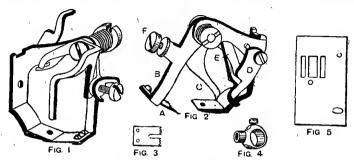
another application of water glass, will be effective.

Making Ruffler for Sewing Machine.—Fig. 1 represents a ruffler or gatherer that may easily be attached to any modern sewing machine. The presser foot and ruffler are shown all in one, but it would be quite a simple matter to make this attachment so as to be fixed on the presser foot by means of two screws. Forms of presser feet vary according to the shape of the presser bar to which they are attached, and the illustration simply shows one kind of foot in use. It is a blank foot having a small hole drilled in it, through which the needle passes, and it is well beveiled from the front edge to the rear of the needle hole to admit the material as it is gathered. The crimping blade a (Fig. 2) is attached to the lever B by means of two screws. It consists of a piece of very thin steel bearing at the end teeth like a saw, and with a long slot to prevent it striking the needle in its forward movement. It is illustrated by Fig. 3. The ruffler gains its action from the needle bar. A special needle clamp (Fig. 4), having a boss, is placed on the needle bar, which, as it descends, comes in contact with the ruffler lever c (Fig. 2); thus it gives motion to lever B, which holds

easily be ascertained whether the barrels are dry or not; if dry, the rust will five fi quickly when the scratch-card is applied; but if not dry, the rust will atherefirmly, and the barrels will present a streeky appearance. As soon as they are scratched off the barrels must be recoated, and left till late in the atternoon or evening. They must now be boiled in clean, soft water for twenty minutes, and, after taking out of the boiling water, must be left till cold, then recoated lightly and allowed to stand till morning. On the third day the same process must be repeated. So, too, on the fourth day, except that, after boiling and soratching, the barrels must be immersed in hot water, and, when nearly cold, cited inside and out with nestsfoot oil. The barrels should slways be cold before boiling; the same water can be used for boiling all through the process, being replenished as evaporation takes place. A tin boiler can easily be made with a few sheets of tin. The wooden plugs for holding the barrels can always be removed when ecalding barrels, the water being allowed to flow through them; and it must be perfectly understood that nothing of a greasy nature must come in contact with the barrels while they are being browned. Turkey sponge should be used when coating the barrels.

Fitting up Baths.—Copper baths are the best.

Fitting up Baths.—Copper baths are the best, although those made of cast-iron answer very well, especially when they are not to be enclosed. On no account should the bot and cold water supplies be strached to the waste pipe or enter through the bottom of the bath. The cocks should be fixed in view, and the water run in at the top. Where the escaping steam,



Ruffler for Sewing Machine.

the crimping blade A. The return action is caused by a coil spring, which can be seen better in Fig. 1. The stop lever D (Fig. 2), if brought against the lever E, forces the crimping blade out of action, so that an operator could hegin by doing a little plain stitching, then a plece of ruffling, and finish off with plain stitching. It is a simple device, but exceedingly handy. Fig. 5 shows a special needle plate; this, with a feeder to correspond, is necessary. It will be noticed that the feeder slots are behind the needle hole only. The feeder must not be in front of the needle, or the crimping blade will strike it and do damage; besides, its action would probably be impeded. Finally, F (Fig. 2) is an adjusting screw, with lock nut, by means of which the gathers may be made close or scant, as required.

Browning Military Rifle Barrels.—In preparing steel or plain iron barrels for browning, whether for military or sporting purposes, the same plan is adopted for making them bright as given for twist barrels on p. 353. The next thing to do is to boil the barrels in a strong solution of sode and water, about ½ lb. of soda to the gallon, for twenty minutes; this is done to remove the grease. After taking the barrels out of the soda water, wash them in clean warm water, and wipe them with a clean rag. When cold, coat them with the following mixture, rubbling it well in: ½ oz. of nitre acid, 2 oz. of spirit of wine, 3 oz. of spirit of nitre, 3½ oz. of tincture of steel, ½ oz. of blue vitriol, ½ oz. of corrosive sublimate, and 12 oz. of spring water. The quantities given are sufficient for browning sixty harrels, if used carefully. The barrels must now be left to stsand all night. Usually in a gunmaker's shop a drying room is fitted up for this purpose, with a small box stove in the centre, as the room requires to be heated to about 80° F. to properly dry the barrels, so that they may receive two coats each day. At the same time an old case lined with tin, placed near the fire in a warm room, can be made to answer the purpose when two or three barrels only are required to be browned. On the second day scratch the barrels off with scratch-card if dry. It can Browning Military Rifle Barrels.- In preparing

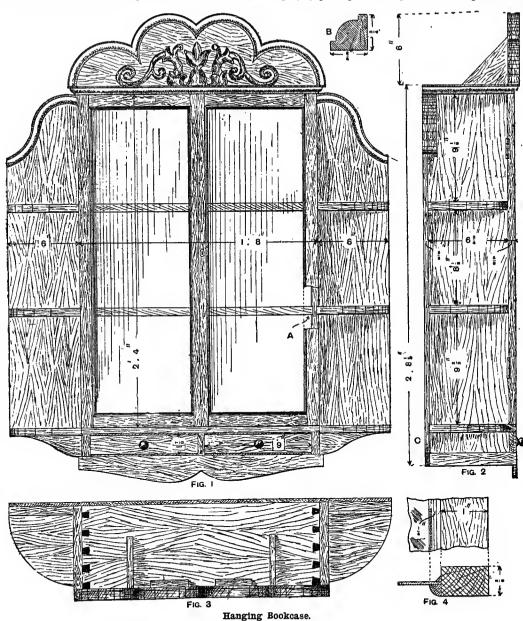
when hot water is being drawn, is objected to, the supplies should be connected to the sides, or the toe, of the bath, as near the bottom as convenient for covering the ends with water as quickly as possible. The supplies should be connected to the sides, or the toe, of the bath, as near the bottom as convenient for covering the ends with water as quickly as possible. The waste pipe should be of a good size—not less than 2 in. In diameter—not only for emptying the bath quickly, but also for flushing the drains, and should be made to discharge beneath the grating of, or into a grated channel leading to, an "interceptor" trap. A lead trap of the same diameter as the waste pipe should be fixed so close to the bath as convenient, and the waste valve or plug, whichever is used, should also have a clear waterway of the same area. To prevent syphomage of the water out of the trap, a ventilating pipe should be attached to the trap and continued to the outer air; and should have a cross-ber-wired end for keeping out birds, etc. The bath should have an overflow pipe of a good size connected to the trap, or made to discharge through an external wall or into the "safe." The latter arrangements, although sometimes objected to, meet some water companies' requirements. All baths fixed above ground level should have impervious floors beneath them. When made of wood, the floors and cellings below should be protected by covering the former with a lead safe turned up all round, the bottom being a few inches larger than the bath, in order to catch any overflow or water splesshed over by the bather. An overflow or water splesshed over by the bather. An overflow or waste pipe should be continued 2 in. or 3 in. beyond the face of the nearest external wall. The bath should be fixed with the head facing the window.

Slip of Propeller.—Slip is the speed of the propeller minus the speed of the ship; this should be about 20 per cent. of the speed in the best cases, and should always be aimed for, although in very small launches, where the propeller is working mostly in broken water, from 30 per cent. to 40 per cent. should be allowed. The pitch of a propeller should be found thus: Pitch epeed + slip = revolutions. The speed is in feet per minute, and

revolutions also the slip.

Design for Hanging Bookcase.—To make the bookcase shown in Figs. 1 and 2, first procure 10 ft. of §-in. by 6½-in. mahogany or wainut for the rectangular frame. The two side pieces (Fig. 2) are continued downwards for 3 in., and on the inside of these, and 2 in. below the bottom shelf, two strips of wood are tacked or glued on. Another piece of wood, § in. by 6§ in. by 3 in.,

made to engage with a hole drilled in a brass plate, which should be sunk into the shelf. A narrow strip of \(\frac{1}{2}\)-in. round beading should be glued round the inside of the doors, as shown in Fig. 4, or the frame may be rebated and a fancy moulding run along the outside. The glass for the doors is held in position, as shown in Fig. 4, by glueing a few strips of wood along the inside

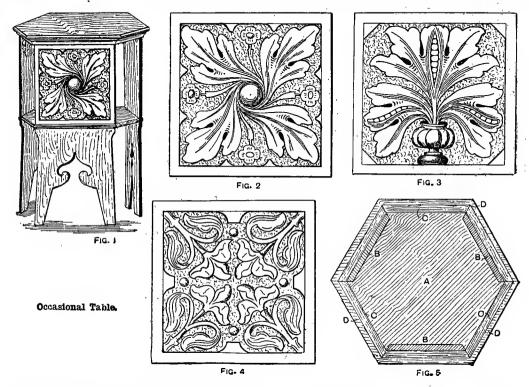


is also nailed to the centre of the shelf underneath, and projects downwards to correspond with the sides. Two strips of wood are likewise fastened on each side of this, and on them silde the two drawers, which are 9 in. by 7 in. by 1½ in. deep, with a small bead running along the front at the top and bottom. The two middle shelves are let into the sides as at A (Fig. 1), and may be spaced out as seen in Fig. 2, or according to individual requirements. The two doors are made from 1-in. by §-in. stuff. They are 10 in. wide by 2 ft. 4 in. in length, and each is fastened by two hinges. A small catch should be screwed inside the left-hand door and

of the frame. The moulding (Fig. 5) for the top and sides can be turned in the lathe in the form of a ring, cut up, and glued to the top of the board, and to fill in the space in the top of the case a little fretwork or carving may be introduced. The three shelves on the sides are all of one size, or the bottom one may be larger and the other two made smaller. They are fastened to the sides of the frame as indicated at A (Fig. 1), and should be of the same thickness as those on the inside. The back of the case is § in. thick (see Fig. 3). The three shelves should be covered with green baize. The whole can then be cleaned up and French-polished.

Occasional Table in Carved Oak.—For the occasional table illustrated in Fig. 1, the three side pieces forming its legs are of \$\frac{2}{4}\$-in. oak, 10 in. wide and 1 ft. 11\frac{1}{2}\$ in. long, the height of the table when fitted with its top being 2 ft. The lower part of each side piece is shaped with the frame-saw, and thus far all three pieces are alike. The carved sunken panels above are, however, all different, and are shown to scale in Figs. 2, 3, and 4. In all of them the ground is roughened with the grounding punch. The table is adapted for home making, all its parts being screwed together. The upper ends of the side pieces are screwed to a false top which fits within them, as may be seen in Fig. 5, which shows the under side of the top. The false top A is of \$\frac{2}{3}\$-in. deal, and openings are cut in it to receive the side pieces B, the corners of which are trimmed to fit. A circle of 10-in. radius will touch the angles of the false top. Round them and the false top, and coming flush above, run strips of moulding, c, \$\frac{2}{3}\$ in. high and 1 in. wide. On these pieces rests the true top A, which is of

a point is made at one end. The bar is then made reduct to anneal the metal, then drawn through steel diesely steam machinery to smooth the surface, and thus reduce its diameter to la in. The exterior is still somewhat rough, and this roughness is taken off either by shaving off the silver with a knife or by turning it off in a latthe. The bright surface is next coated with a calculated thickness of gold leaf, and this is enveloped in several folds of paper securely bound with string. The swaddled silver bar is then laid on a bed of glowing charcoal, covered with a layer of the glowing coal, and allowed to remain until red hot. At this stage the leaf gold is in a state of semi-fusion, and is burnished into the surface of the silver with bloodstone and other burnishers, whilst the bar is held by clamps in a machine which turns it slowly round whilst it is being burnished. Next the bar is allowed to cool, and is then ready for the wire-maker, who coats it with beeswex, and draws it through a succession of highly polished, graduated steel dies by machinery. As the bar hardens



½-in. oak, and its angles would touch a circle of 12-in. radius; its edges D are neatly rounded, and it is fixed by screws driven into it through the false top. At 1 in. less than half-way down is a shelf, shown in Fig. 1, which gives such further connection to the side pieces as is required. It is of ½-in. oak, and screws are driven into its edges through the side pieces. The heads of these screws are hidden by a ½-in. moulding, which appears in the same figure. Fig. 1 is roughly 1 in. to the foot; Figs. 2, 3, and 4 are on a 2-in. scale; and Fig. 5 is 1 in. to the foot.

Making Gold Lace.—Gold lace consists of a gold filsment, either rounded or flattened, wound round a filament of silk, and woven with silk to form a ribbon. The gold-coated filaments are named gold threads. The same gold threads are made into braids and cords. Some of the gold lace, cord, and braid is made in solid fine wires interwoven with silk. Epaulettes and badges are made with combinations of gold wire, some of which is first made into spirals, named "purls," some into parrow ribbon named "broad plate," and some into small rings, which are then beaten flat to form "spangles." But the gold wire of the gold kace-maker has a foundation of silver overlaid with gold, and is therefore a gilt wire. A round bar of silver weighing about 400 oz., and having a diameter of about 2 in. and a length of 2 ft., is first lorged down to a diameter of 1½ in., and

in the process of drawing, it has to be annealed frequently, and the gold coating is protected from injury by a coating of beeswax before it is drawn through fresh holes. As gold is a very ductile metal, and the coat of it on the silver har is well burnished into the silver, it firmly adheres thereto, and lengthens with the underlying metal, maintaining its hold thereon even when drawn to the finest wire. When the bar has been reduced to \(\frac{1}{2}\) in. in diameter, it has reached the wire stage, and is then annealed in coils; and run off from hanks held on suitable rolls to other rolls. Thus it passes on from hand to hand, gradually getting longer and finer until it becomes as fine as hair, and measures some 1,400, 1,600, or even 6,000 yd. to the ounce troy. Even then, if it is of good quality, and has been properly treated, it has all the appearance of real gold wire. If the gold lace is to be of solid wire, this is drawn clean and bright, and left round; but if it is to be made of gold thread, the wire is next run between polished steel rollers in a flatting mill, and thus converted into a ribhon which is subsequently rolled round a filament of silk to form gold lace thread.

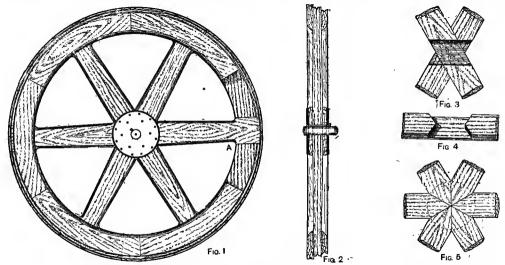
Rack for Holding Washers.—To hold washers of

Rack for Holding Washers.—To hold washers of different varieties and sizes, a suitable rack consists of a varnished pine board into which round iron rods like long nails are driven. The rack is fastened securely to the wall, and the washers are placed over the rods.

Three-speed Wooden Driving Wheel for Lathe.—In fitting up a small lather or bench lathe a difficulty is sometimes experienced in procuring a suitable driving wheel. This difficulty may be overcome by making a wheel in hard wood, as shown in front and side elevation by Figs. 1 and 2. The wheel may be from 20 in. to 30 in. in diameter as required. The arms are made of stuff 2½ in. wide by 1 in. thick, and may be housed together by the method shown at Fig. 3, each of the three pieces used being long enough to cross the full diameter of the wheel, thus forming two arms. Each piece is out away to fit the others, leaving one-third of the total thickness in each piece, one of which is shown at Fig. 5, where the ends of the six arms are merely butted together. In either case a hard-wood boss, about 4½ in. in diameter and ¾ in. thick, is corewed and glued on each side of the arm centre, and ¾ in. is gauged and planed off each side of the thickness of the arm ends, thus tapering them to ¾ in. thick. The arms are also tapered down to 2 in. wide inside the rim, as shown at Fig. 1. Cut eighteen segments of hard wood, ¾ in. thick, to form the rim. The centre layer has each segment fitted between two arms, as shown at A (Fig. 1). The top and bottom layers are glued and screwed in position, the joints being lapped. One top segment has been removed at A, which clearly shows how the joints are lapped. The wheel should now be fixed in a lathe and the rim turned to the section shown at Fig. 2, three

solution of lead acetate; the lead cleate separates as a yellow sticky mass which is washed and pressed. Lead-linoleate is prepared in an analogous manner to the cleate, using linseed cil in place of clive cil; it is a yellow mass, but in contact with air oxidises rapidly, turning brown; it is a very active drying agent, and is no doubt present in boiled cil prepared with litharge or red-lead. Manganese dioxide (MnO₂) occurs native as the mineral pyrolustie; it is simply ground to a fine powder for use. Manganese borate is formed by mixing together solutions of manganese sulphate and borax. Manganese sulphate is prepared by boiling manganese of dioxide with sulphuric acid. The cleate and linoleate of manganese are propared in a similar manner to the lead compounds, but using manganese sulphate for precipitating the scaps.

Hints on Casting Aluminium. — When casting aluminium, pour the metal as cold as possible, but, of course, pour thin castings botter than those of heavier section. A convenient way of ascertaining the temperature of the metal is as follows: If its colour is red, stir with a pig of aluminium until it is white. The metting of the pig will serve as a guide so far. Then dip the end of a cold pig \(\frac{3}{2}\) in. or so into the metal, when the aluminium will chill around the pig, and when the latter is withdrawn from the metted metal it remains like a little cup on the surface of the metal. The time required for this chilled metal to melt gives



Wooden Driving Wheel for Lathe.

speeds being provided. The centre hole should also be bored in the lathe, after which the two 1-in. iron plates shown in Figs. 1 and 2 should be screwed over the wooden bosses, the centre holes having been previously drilled to fit the spindle, and a keyway cut. The spindle is next inserted and keyed up, and if the wheel does not run exactly as it should, it may be trued up in its place.

Driers for Paint.—Boiled linseed oil, being a drying oil and containing either a lead or manganese compound, is a drier; but in paint-making, besides boiled oil, there are often added certain metallite compounds which shorten the time required for the paint to dry. The chief simple driers used are compounds of lead and manganese, but in the patent driers these are mixed with copperas, sulphate of zinc, zinc white, etc., and often large quantities of inert materials, such as barytes or gypsum. The compounds of lead usually employed as driers are litharge (PbO); red-lead (Pb₂O₄); white lead; lead acetate (Pb(C₂H₃O₂)₂); lead oleate; and lead linoleate. The manganese driers are manganese dloxide (MnSO₄); manganese borate; and manganese lunoleate (MnSO₄); manganese borate; and manganese oulphate. Litharge is the monoxide of lead (PbO); it is prepared by roasting lead in a reverberatory furnace, as in the first stage of the preparation of red-lead. Lead acetate is formed by dissolving metallic lead in acetic acid and crystallisting out the compound. Lead oleate is really a lead soap, known to the pharmaceutical chemist as "lead plaster"; it is formed by saponifying olive oil (olein) with caustic soda, and precipitating with a

a good idea of the temperature of the metal in the crucible. Use sand as dry as possible, and avoid sponging a mould. A little filing on the casting where the mould tears up is preferable to a lost casting. Small hodies of sand nearly surrounded by metal, such as the centre cores of small set collars, are almost certain to blow if the core is a little damp. Use heavy gates. In some cases, however, it will not do to put a large gate on a thin casting, as the gate sometimes draws from the casting. Pour rapidly, and just "dump" the metal in. Aluminim is not so liable to wash away portions of the mould as other metals, owing to its lightness. Ram the moulds very softly; it is not necessary to ram them nearly as hard as for iron, as aluminium is but one-third as heavy. Soft ramming will very often prevent the breakage of castings when they "set." The reason for this is that aluminium just after it solidifies, is very weak and crumbly, and will scarcely bear its own weight. Vent all moulds well.

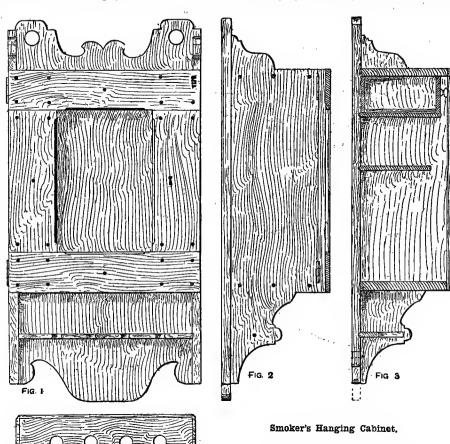
Power Transmitted by Belts.—To find the power a helt will transmit, the following rule has been given: When the pulleys differ in size, only the small pulley must be considered. The number of degrees of belt contact on the small pulley must be got at as nearly as possible. For 180° the useful effect is 1; for 1573°, useful effect '92; for 135°, useful effect '84; for 1128°, useful effect '76; for 90°, useful effect '64. Rule: divide the speed of the belt in feet per minute by 800, multiply the quotient by the width of belt in inches, and by I when the arc of the contact is 180°, and proportionately for other degrees of contact.

Improving Margarine.—Margarine is improved by imparting to it the aroma and taste of natural butter. The Poppe process for accomplishing this is to add to the margarine a latty acid product, obtained by saponifying butter, decomposing the soap, and distilling it in a vacuum at about 60° C. The addition of the product is made on emulsification of the fats with milk. The margarine is said to keep for months.

Smoker's Hanging Cabinet.—In its upper and lower parts the cabinet illustrated in elevation by Figs. 1 and 2 will give a little work to the fret-saw. It should be made of hard wood—walnut by choice—½ in. board being used, except in some minor parts, where ½-in. will be found sufficient. It is: 1 ft. wide and 2 'tt. high, the projection from the wall being 6¾ in. As it is to be made

wide by ½ in., and the upright ones 3 in. Small, round-headed brass screws are used for this purpose, whilst somewhat larger screws of the same kind are used in the sides. Holes are provided near the top (see Fig. 1) by which the cabinet can be hung on two brasa-headed nails, or, better, on two small brass hooks, firmly fixed in the wall. If, instead of hard wood, ebonised pine should be chosen, to avoid danger of breakage it will be desirable to make the pipe-rack of ½-in. board instead of ½-in. The scale of all the illustrations is 2 in. to the fect.

Flexible Cords for Extending Electric Bell System.—When temporary extensions of an electric bell system are desired, such as a line to ring a bell or dinner gong on a table, it is advisable to use a tem-



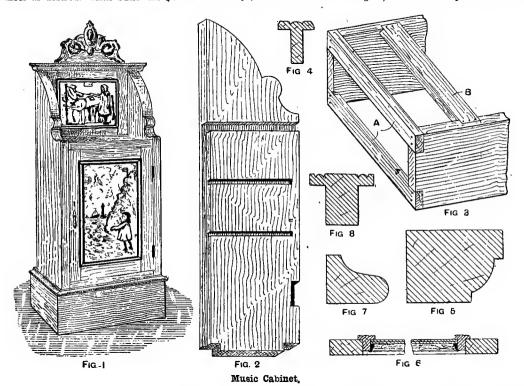
by the home carpenter, it is arranged to be put together without dovetalling and with screws merely.
The back, sides, top, and bottom are all of ½-in. board,
and the sides are fixed to the back by screws driven from
behind, whilst the top and bottom are screwed in place
through the back and sides. The horizontal partition on
which slide the drawers, the upright piece between
them, the small shelf below the drawers, and the piperack, are all of ½-in. board, fitted into V-shaped grooves,
as shown in Fig. 3. The two drawers, which are of a
cize to hold cigars, are also of thin board. The fronts
of the drawers project ½-in. less than the side pieces,
so that their handles may not interfere with the closing
of the door. The shelf below the drawers has a projection of 4½-in. only, as will be seen in Fig. 3, and the
pipe-rack (Fig. 4), which comes below the cahinet proper,
has a projection from the back of 3 in. The door lies on
and closes against the sides, the top, and the bottom,
and is made in two layers of board, the inner thickness
being of ½-in. wood, 1 ft. by 1 ft. 2 in. On this the strips
of the outer layer are screwed, the cross ones being 2½ in.

porary line of flexible conducting cord, run under a carpet. The use of such flexible conductors is also necessary to extend the system in bedrooms to the side of a bed. As single copper wires would be stiff and liable to become brittle from frequent bending, a flexible conductor is made by massing six, nine, or twelve fine soft copper wires together under one coating. The wires in general use for this purpose are Nos. 36, 36, and 40, and the conductors are distingiushed as 636, 9/38, and 12/40, etc., the gauge of wire being placed in the last place and the number of strands first. These cords are sold under the name of pear pressel cords, thin, medium, or thick. The insulation is usually of longitudinal strands of cotton, overwound spirally with green silk. In the thin and commoner kinds the two covered conductors are simply twisted together to form the cord; in the thick cord a third strand of silk-covered cotton is introduced to form a threefold cord. In a better class the two conductors are enveloped in a braided coat of silk. In a still better class a rubber insulation is added, which varies in thickness with the price paid for the article. These cords are also made to order in a variety of fancy braidings in cotton, glace cotton, worsted, and silk.

Music Cabinet.—Fig. 1 is a general view of a music cabinet the materials for which cost but very little, as practically the whole cabinet was made from parts of a footpiece of an old wooden hedstead, which was cut into five pieces. A moulding running round the top of a bottom overlay piece was first taken off. The end pieces on the footpiece, being curved, were not used. From the two other pieces the sides of the cabinet were made without any further cutting (see Fig. 2). The sides have three grooves and a rebate, the widest groove being for the top of the cabinet. The two smaller grooves are for the shelves to slide in, and the rebate at the back is for the matchboarding to form the back. Two rails are malled across the bottom of the sides as shown at a (Fig. 3), and these, with the top fixed in position, held the cabinet together. Across the front of the cabinet, 7 in. from the bottom, a 3-in. by 1-in. rail B is let in. When fixed in position, the front edges of the cabinet should be overlaid with \(\frac{1}{2}\)-in. mahogany or mahogany veneer as desired. Then build the \(\frac{3}{2}\)-in. side overlays,

in. less than the door frame, this allows for a further backboard to be screwed on. The cabinet is now ready for staining and polishing, a nice dark tone being preferable. When the polishing is finished, the door should be hung on its hinges and a lock fixed, as shown in Fig. 1. A small piece of oak is screwed inside the cabinet at the left-hand side to act as a step for the door, and also to receive the look.

Manufacture of Blacklead Pencils.—Pencil woods are, or have been in the past, chiefly manufactured from cedar derived from the west coast of Florida, the logs of cedar measuring on an average 1 ft. square end 12 ft. long. In the manufacture of the pencils, the wood is cut into thin boards, slightly thicker than half a pencil, and about the width of six pencils placed side by side. It is next dried by steam for about four weeks, and then taken to a special machine which makes six grooves, taken to a special machine which makes six grooves, the size of half a lead and the width of a pencil apart, down each board. These six-width slabs are then smeared with glue, and the lead pleces are laid



mitreing the pieces to receive the front overlay with mitred corners. Then mitre the moulding at the corners and fix in position. On the top of the two cross rails inside the cabinet is a shelf which forms a well bottom to the cabinet. Slide the two shelves in the grooves, and then nail on the matchboard backing. The back at the top of the cabinet is a plain frame, 2 in. wide, mortised and tenoned together. The inner frame is of oak, with a rebate at each side, the front being reeded, as shown in Fig. 4. Next glue and nail the moulding inside the plain frame, after fitting it together as for a picture frame. The moulding should be etained dark and polished before being fixed. The whole frame can now be fixed to the cabinet at the back with screws, inserted in a alanting direction, one at the bottom and one at each side. On the top is a moulding (Fig. 5) cut from a piece of pine, and held in position with two screws fixed through the centre. The screws are concealed by the carved piece. This is mounted on \$\frac{2}{2}\$-in. stuff by means of ecrews, the whole being fixed with a dowel peg and nails at each corner. The door of the cabinet is made from \$\frac{2}{2}\$-in. walnut, and consists of a 2-in. frame mortised and tenoned together. It has an inner frame made similar to the frame at the back, and Fig. 6 gives a section of the door. The backboard that holds the glass and pictures in position is fixed by nailing round a narrow strip. As the inner moulding is

in their respective grooves, the second slab of each pair being brought down by pressure and held securely in position until the glue becomes dry. The joined slabs are then subjected to the action of a special rounding machine, which shapes the outside parts, and at the same time separates them into single pencils. The pencils are then coloured and finished. The lead used in most pencils is a composition of a natural graphite and a particular kind of clay. The graphite is washed, ground into powder, wetted, and mixed with the fine clay (which gives it tenacity), and while still in a soft condition is squeezed, macaroni-like, through dies of a suitable size, and afterwards baked.

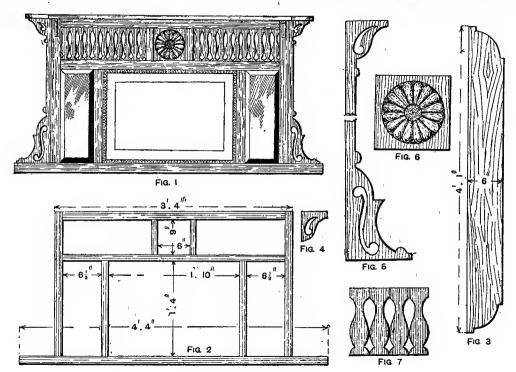
Factors Determining Speed of Vessels.—The question of speed is really the most intricate of all the problems involved in the design of a lannch, including, as it does, the calculation of the power required. Certain practical considerations determine the utmost possible speed of every boat. This is determined by (a) the fineness of the block coefficient, as the smaller it is the less will the hull dissipate energy; (b) the power effectively delivered by the engines, relative to the total displacement of the lannch; (c) the disposition of the displacement; and (d) the amount of wetted surface, and eddy-making resistance due to planes moving normal to themselves.

Making Rubber Tubes Gas-tight.—To do this, 'coat them with a mixture prepared by dissolving 5 parts of gum arabic and 3 parts of molasses in 15 parts of white wine, and adding, with constant stirring, 6 parts of alcohol in small quantities. Stirring is necessary to prevent the alcohol precipitating the gum arabic.

Picture Overmantel.—The picture overmantel shown in elevation by Fig. 1 is very effective, and simple in construction. The framework (Fig. 2) may be made of whitewood or pine, the joints being mortised and tenoned. The base and top rails and two end uprights are 1½ in. by 1 in., the other parts being 1 in. by 1 in. When the framework is made, the whole of the front is slipped with oak, 1½ in. wide by ½ in. thick. The slips are gined on, and a few needle points should be used to keep them fixed till the glue sets. In slipping, the base and top rails and end uprights form a ½-in. rebate on the inner edges. The inner rail and uprights being 1 in. wide, the 1½-in. oak slip must be put on so as to allow a ½-in. rebate on each side. The shelf (Fig. 3) should be of ½-in. oak, and is screwed to the top rail, flush at the

picture put on its face downwards. It is then damped with a sponge, and turned over. Then the back of the mount is slightly gummed round, and is placed in its exact position on the picture. Place it in the frame, and insert the backboard, fixing it with brads. A sheet of good brown paper should be pasted over the back to make it dust-proof. Finally, the bevelled mirrors should be protected with thin boards.

Preserving Fruit Juices.—This is possible only when the fruit is sound, ripe, and carefully selected; rotten or impaired portions must be carefully removed, or the whole stock is spoiled. The juicy fruits are subjected to considerable pressure, and are crushed and packed into feit or fiannel bags. A common method by which fruit juices are kept from termenting is to add salicylic acid or other antiseptics, which will destroy the fermentative germ, or retard its action for a considerable time. About 2 oz. of salicylic acid, previously dissolved in alcohol, to 25 gal. of juice, or 40 gr. to the gallon, is generally considered the proper proportion. One trade process for preserving the juice



Picture Overmantel,

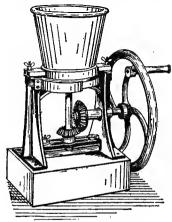
back edge. The bracket supports (Fig. 4) are each secured with two screws through the uprights and one through the shelf. Fig. 5 shows the end ornaments, which are also of \(\frac{2}{2}\)-in. cak; they should be neatly fitted in place and fixed with glue, a sprig being used for each end. The fret-out panels are of \(\frac{2}{2}\)-in. oak, and should be nicked with a V-tool or chisel to give them the appearance of being divided, thus representing pillars standing side by side (see Fig. 7). The sunflower design for the carved panel looks well if neatly executed. All the oak should now be darkened with a walnut stain, and when thoroughly dry French-poished, the panels being treated before inserting. The panels are fixed with blocks glued at the back. A length of fancy burnished gold silp that can be obtained at any picture-frame maker's is fitted behind a rebate of the centre of picture space, and a square of 15-oz, glass is fitted. The mount for the picture must be cut from a gcld-tinted mount board, size 2 ft. 1 in. by 1 ft. 8 in., known as "Royal." When cut to dimensions, 1 it. 10 in. by 1 ft. 4 in., mark it for a 2-in. margin, and cut out on the bevel with a sharppointed knife. Cut the mount on a waste plece of the mount board, otherwise the grain of the wood of the bench top will send the point of the knife astray. Now put in the glass, and prepare the beschoard. A sheet of clean paper is then placed on the bench, and the

is to pour the freshly expressed cold juice into bottles until it reaches the necks, and on top of this to pour a little glycerine; then the juice will keep unchanged in any season. Probably one of the best methods of preserving fruit juices is to add 15 parts of 95 per cent alcohol to 85 parts juice; this causes alhumen and mucilaginous matter to be deposited, and the juices may then be stored in securely closed bottles, jars, or barrels. If allowed to remain undisturbed they become perfectly clear, so that further clarification is unnecessary; the juice should then be decanted or syphoned off. An efficient way to clarify fruit juices is to heat them to near the boiling point of water with a small quantity of albumen (white of egg) without stirring in an enamelled vessel provided with a close-fitting lid; the impurities coagulate, and either rise to the top of fall to the bottom, and the juice is then filtered through elt or flannel. The heat effectively destroys the germs of fermentation, and the subsequent filtration clarifies the juices, which should be kept in a cool place, where they will remain unchanged for an indefinite period if properly and carefully prepared. Corks should be coated with wax, and if possible the bottle necks should be dipped. No more heat than is absolutely necessary should be applied or the delicate aroma of the fruit will disappear.

Removing Grease Spots from Wall-paper.—The wall-paper may be cleaned by first brushing it down and wiping with a clean chamols leather to remove loose dust, afterwards rubbing with stale bread which has been cut into squares for convenience for handling, the crust having been previously removed. Two or three thicknesses of clean blotting-paper laid on a grease spot, and kept in position for a short time by firm pressure with a hot iron, will generally remove such blemishes. Benzine, carefully applied, is also effectual.

Benzine, carefully applied, is also effectual.

Paint Mixing and Grinding.—In the preparation of paints, the dry colours are mixed with linseed oil and ground in special plant. A simple form of paint-grinding machine is the cone mill, which may be worked either by hand or by a belt from shatting. This machine consists in principle of two cones, one of which is fixed while the other revolves. The hopper is fixed by two binding screws, and may be removed for cleaning purposes. Against the bottom of the hopper is fitted a cone-shaped arrangement which is caused to revolve by spur-wheels beneath; the mills are either made for working by hand (Fig. 1) or may be run from a shaft. The paint is placed in the hopper and falls by gravitation between the two conical surfaces, where it is ground into a uniform paste which cozes out at the junction and is scraped off from time to time, or it may he allowed to fall into a trough placed beneath for its

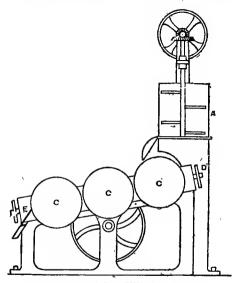


Hand Paint Mill.

collection. Paint grinding is now very largely performed by roller mills, of which there are many forms; in this method it is necessary to mix the dry pigment and oil together in a pug mill before submitting it to the rolls. The pug mill is sometimes worked alone, but very frequently it is fitted up as a part of the grinding machine, as in Fig. 2. This figure gives a section of a roller and pug mill combined. The pug mill consists of a cylindrical iron vessel A (Fig. 2), having a shaft in the centre, attached to which are a series of arms or knives B B; the shaft is caused to revolve, and the arms or knives then serve as beaters, thoroughly mixing and amalgamating any materials put into the mixture of oil and colour is allowed to flow from the opening at the bottom of the pug mill down a shoot, which delivers it between the first and second rollers; in these rollers the grinding commences, and the oil and colour are, so to speak, pressed closer in contact as they become more finely divided; the paint is then drawn over to the third roller by adhesion, is further ground, and is finally removed by the scraper B and falls down a shoot into the receivacle placed beneath to receive it.

Curing Smoky Chimneys.—An insufficient supply of air is often the cause of a chimney smoking, but it is sometimes found that the evil exists not so much in the quantity of air as in the direction from which it comes. In very many cases it is found that opening the door of the room will remedy the evil; but, though this may be efficient as a temporary measure, it is evident that some means of absolute cure will have to be devised. A ventilator similar to those used in external walls will, if fixed near the ceiling of the room, often cure a smoky chimney, besides ventilating the apartment. A scheme for allowing fresh air to pass through a grating placed in front of the hearth has been advocated as a successful

remedy for very bad cases. Another cause of sluggish draught is cold air getting in the corners of the ordinary-shaped flues, and the longer the flue the more liable is it to be affected in this way. The object aimed at is to oause the up-draught to be continuous, and, as far as possible, to do away with the least suspicion of a downdraught. If the chimney opening is larger than ordinarily is the case, a smoky chimney may result, the cure being to diminish the opening, for which purpose the old-fashioned tin blower is often used. In the case of smoky chimneys in an open and exposed situation, a very frequent cause is down-draught. A cure for this a generally effected by the use of one of the various chimney cowls that have been devised. Some cowle permit the smoke in ordinary weather to escape from the top in the usual way, and in strong winds and gales to escape at a lower level in the cowl. As a general rule, it may be taken that for a high chimney a cowl of medium height is best, so as to lessen the chance of its being blown down in high winds, whilst for a low chimney a cowl about 5 ft. high is suitable. Probably the most troublesome cases to deal with are those in which the chimney is lower than the adjacent buildings. Galvanised-iron tallboys can be obtained up to about 10 ft. high, and might answer, but where there is a great



Roller and Pug Mill Combined.

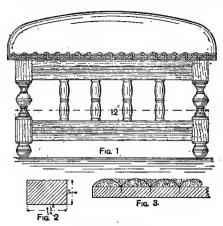
difference in the height of the chimney and that of the adjoining houses a galvanised pipe with a cowl on top carried up to the level of the buildings may be employed. Where a very simple remedy is needed, terracotta louvred chimney pots may be used. Choose one that fits the present chimney pot, and so saves alteration; see that it is so constructed as not to be damaged when the chimney is swept. The lighter a revolving cowl is made, consistently with strength, the better; one that requires a very heavy wind to turn it should be avoided. A cowl in action should be nearly noiseless. The iron and zinc chimney pots known as "tallboys" are to be had in zinc as thin as 10 gauge and about 7 ft. in height, and in galvanised iron in 20, 22, and 24 gauge, and from 6 ft. to 10 ft. high. It is a mistake to suppose that any revolving cowl will keep in order year after year without being examined and olled occasionally, although some of the best contain oil enough to last for years; such cowls often have their internal fittings of brass or copper, either of which adds greatly to the durability.

Whirler for Drying Negatives.—To make a simple whirler for drying photographic negatives, buy a sixpenny egg-whisk having a pair of hevel wheels, and cut away part of the tin strips and all the wires attached to one of the revolving spindles. Get a shilling pneumatic holder, and bend round the builb of this the strips of tin remaining attached to the other spindle, making all fast by soldering on a band to them. The plate is fastened to the holder in the usual way, and the handle of the whirler heing turned, the plate revolves at great speed, throwing off the moisture in doing so. The plate is held face downward to prevent being thrown off.

Pit Sand, River Sand, and Sea Sand in Plasterers' Work.—The different kinds of sand should be placed, as regards usefulness, in the following order: (1) Pit sand; (2) river sand; (3) sea sand. Pit sand is the best on account of the sharper angles and the rougher surface of the grains, but it must be freed by washing from earthy, loamy, or clayey matters. The grains of river sand usually have smooth and round surfaces. This sand, therefore, does not form so good a key as pit sand; it is largely used for roughcast work, and should always be washed. Sea sand should not be used for general plastering work, the grain being round and smooth, and containing various salts which cannot be altogether removed by washing. A wall plastered with sea sand would be permanently damp.

Would be permanently damp.

Upholstered Footatool.—Birch is a very suitable wood for making the frame of the footstool shown in the front elevation, Fig. 1, being very clean to work, and allowing a good finish to be got in the turned portions. Of course, the stool may also be constructed of oak, walnut, or mahogany, as may be most in harmony with the surrounding furniture. The stool measures round the frame 1 ft. square. The corner pillars are 1 in. thick when finished and 6 in. long; of these, four will be required. For the eight spindle rails 8 ft. of stuff 1\(\frac{1}{2} \) in. thick will be required; work in 4ft. lengths, which will make four rails; plane up to 1\(\frac{1}{2} \) in. thick. A double bead is run through the centre of the face side only (see Fig. 2); this can be done with a beading plane with adjustable fence, or with a hand scratch tool. Saw into lengths exactly



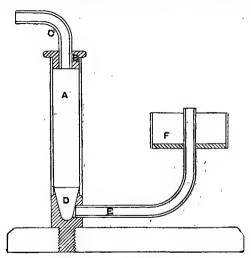
Upholstered Footstool.

It in, long. These rails are stump-tenoned into the corner pillars to the depth of ½ in, at each end. Sixteen spindles, each ½ in, long, will be required; these are secured to the rails with tenons at each end ¾ in, diameter, turned in the latthe, fitting into holes bored in the insides of the rails at equal distances apart. When all the jointe have been squared and fitted, the frame can be glued up and put aside to dry. The top board, which forms a foundation for the seat, is of pine 11 ft. 1 in, square by ¾ in, thick; this will give ½ in, of a lap all round the frame. It is secured to the frame by screws passing into the top of each corner pillar. A velvet covering for the top can be bought at almost any large drapery store; this must not be less than 16 in, square. Begin stuffing the top by picking balls of flock on all round the edge with loops of twine tacked fast, about 3 in, apart (see Fig. 3); tack the velvet cover fast on two sides, and fill up all the space with flock, letting the centre rise well up. Then tack the other two sides. The top should now have a square appearance all round the edges; cut off straight, then run a narrow seroli gimp round the edges, securing this with black gimp pins.

Repairing and Distempering Old Ceiling.—
The old distemper should be removed by washing off with hot or cold water, using a scrub or worn-out distemper brush and paperhangers' canvas and sponge. Cracks and rotten places should be cut away, the surface being slightly underent to furnish a bolding place for the new plaster. The broken places should be mended with Keene's cement, or plaster of Paris mixed with rain water, a little whiting being added to keep it from setting too quickly. The mended places should

have a coat of paint. Stains should be removed by washing with vinegar, or by covering them with paint. Rough places should be smoothed with coarse glasspaper. The walls of a room, before being painted, should be examined for any indications of dampness, the cause of which should be discovered and removed, and the places thoroughly dried. Two coats of patent knotting and a couple of coats of paint may then be applied, after which the walls may be distempered.

Flash Lamp for Photography.—The flash lamps described were used very successfully in taking photographs underground in a mine. It should be noted that the dimensions given are purely arbitrary, and may be altered to suit any odd materials in hand. True the ends of a piece of tube (A) about 3 in. long and § in. diameter. Turn the plug B, mill its edge, and bore a hole through it to take the piece of ½-in. copper tube c, which must be soldered in place. The plug should fit well. Now make D to fit into the other end of A, and turn the conical recess as shown; also the hole through the side to take E (½-in. copper tube). The lamp F is about 1½ in. diameter and § in. deep. The copper tube is best bent after filling it with lead, which may then be melted out. The tube E should be soldered into D, but the latter should only be fitted tightly into A. The addition of a wooden base, about 5 in. by 2 in., will complete the arrangement. Two such lamps must be made. Lamp-wick must be wound in a coll to fit into F, and then saturated with methylated spirit. It is well to hold the



Flash Lamp for Photography.

finger over the end of E when filling, to prevent the spirit running into it. Now half fill a with dry pure magnesium powder. The best way to discharge is by means of a large rubber bulb, which is connected with both lamps by means of tubing and a T piece. The powder should be wholly ejected from both lamps with one squeeze of the ball. The lamps should be held one on each side of the camera, that on one side about 5 ft. from the ground, while the one on the other side should be 6 ft. from the floor. Two such lamps will give a decently exposed negative on liford Empress plates with a lens working at f/16. An excellent developer for flash-light pictures is rodinal 1 part, water 30 parts.

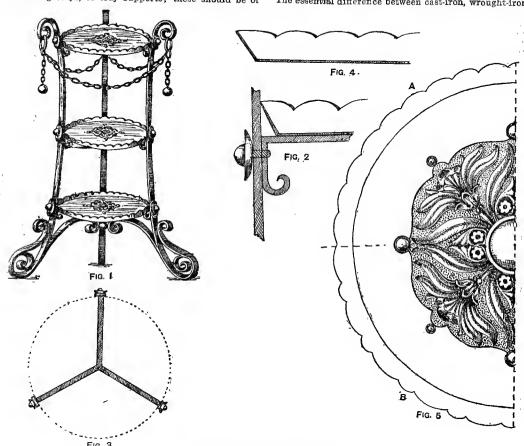
Preparing Ironwork for Painting.—Ironwork in preparation for painting should be first cleansed, all scale and rust being removed with a wire brush. The application of parafin oil will greatly assist in loosening scale. Galvanised iron, after being scrubbed with a wire brush, should be washed with diluted muriatic acid, the proportions being 5 of acid to 1 of water. Red-lead is the best pigment with which to prime ironwork; to tone down its strong colour it is, sometimes mixed with Venetian red. It should be made up with equal parts of boiled oil and turpentine, and be used as soon as it is mixed. A little japanner's gold-size or varnish will help the paint to cling to steel. Galvanised iron which has become greasy should be washed with a strong solution, of soda. Sometimes ironwork is finished in two coats, but if it is twice primed the second priming should contain more turpentine, so that it may be flat for the finishing coat.

Setting Out Openings in Brickwork.—Openings in brickwork for doors and windows on the ground floor are required to be central and symmetrical with regard to the passages and rooms. They are generally arranged to have a width equal to a given number of brick lengths, and any intervening piers are made multiples of a brick or half-brick in width. The openings on the upper floors should, as a rule, be directly over those below, which arrangement is called building void over void.

Metal Stand for Bric.a-Brac.—The stand represented by Fig. 1 is of wrought-fron, with brass or copper trays and ornaments. Fig. 1 shows the complete stand with the three trays in position. The legs are of wrought-fron, \tilde{z} in. or \tilde{z} in. by \tilde{z} in. section, and are bent as shown, the upper end being in a single scroll and the lower in a double one, with a third scroll welded on at the foot. Fig. 3 is a plan of the triple connecting stays, or tray supports; these should be of

of having engraved ornament is that the flat surface of the metal is retained, and there is no difficulty in standing ornaments upon it. A better appearance is given to the stand by adopting brass chains, with ball drops hanging from the scroll tops of the legs round the stand. These additions are, of course, not absolutely necessary. The iron legs may be decorated in various ways. If copper is adopted for the trays, a good dead black will be very suitable, and may be obtained by one or two coats of enamel black. If brass is the material used, marone, plum colour, cream, or French grey enamely paint may be employed.

Distinguishing between Cast-iron, Wrought-iron, and Steel.—Malleable cast-iron is made by heating ordinary castings, preferably of white cast-iron, from two to forty hours, according to size, in contact with exide of iron or powdered red hæmatife, causing partial conversion into wrought-iron by abstraction of carbon. The essential difference between cast-iron, wrought-iron,



Metal Stand for Bric-à-Brac.

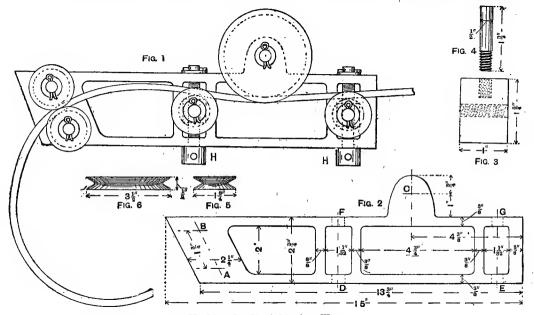
iron, § in. by ½ in., bent at each end into a scroll, as shown in Fig. 2. These triple stays are fixed to the legs in their proper positions by large round-headed screws, each of these carrying a plain, hollowed brass plate, and passing through the plain hole in the leg into the tapped hole in the bent end of the stay. The bottom scrolls are fastened to the bettom triple stay by muts, thus completing the iron framework. The tray (Fig. 4) may be of brass or copper, and is turned up round the edge and scalloped out with a file to either of the patterns shown at A and B (Fig. 5). These trays rest on the stays, as shown at Fig. 2. It is best to have the brass or copper plates ground and roughly polished in the flat sheet. They can then easily be finished and dollied up when the ornament has been put on. An enlarged view of the crnament for the centre of the trays is given by Fig. 5. The ornamentation may be engraved, with the ground matted. The same pattern could be executed in repouses work, but an uneven surface would thereby be given to the tray. The advantage

and steel is the amount of carbon combined with it. Wrought-iron contains from 0 to 0.25 per cent. of carbon, cast-steel from 0.5 to 1.8 per cent., and cast-iron from 2 to 6 per cent. Mild steel is distinguished by the mode of manufacture rather than the amount of carbon, as the percentage of carbon may vary from 0 to 0.5 per cent. In the Bessemer process of steel making, grey pig-iron is used, containing a large proportion of free carbon, a small quantity of silicon and manganese, and no sulphur or phosphorus. The iron is melted in a cupola and run into a converter lined with firebrick and suspended on bollow trunnioms. Air is blown through the metal for about twenty minutes, removing all the carbon; 5 to 10 per cent. of spiegeleisen, rich in carbon, is then added to give the required proportion, and blowing resumed long enough to incorporate the two metals. The steel is then run out into a ladie and thence to ingot monlds. The ingots, being porous, are re-heated and put under the steam hammer, then rolled or worked as required.

Use of Hair in Plastering.—Hair is used in plastering to give keying quality, and to bind the material. Hair should not be matted together, but should be clean and long, and should be well beaten before it is added to the coarse stuff. More hair should be used for ceilings than for walls, the proportion being 1 lb. of hair to not exceeding 3 cub. ft. of coarse stuff. There is no substitute of equal value to ox hair for plasterers' work. Wool might be used, but would not be so efficient, and would also be too expensive. Shoddy, the material used by upholsterers, well carded and separated, might also be used as a substitute for hair, but its value would be small.

Machine for Straightening Wire.—A wire-straightening machine is shown complete in Fig. 1. A cast-iron frame (Fig. 2) is required, and two sliding blocks of steel (Fig. 3) will be wanted. These blocks should be drilled and tapped ½ in. for the regulating sorews and for the stude of the grooved wheels. Five iron stude (Fig. 4) should be drilled, each at one end, for a split pin, and the frame must be drilled and tapped for three of these stude at A, B, and c (Fig. 2), the other stude being screwed into the sliding blocks; the two regulating screws are shown at H H in Fig. 1. On the centre line of the frame drill holes, ½ in. full at D and E, and at F and G drill

these combs the teeth are not cut very deeply into the material; they are merely notches, which can be deepened as the points wear away. Combs of flexible materials give a coft effect, and they make a cleaner combing than steel combs; although the latter are used for giving sharpness and broken effect to the lines, yet they are inclined to give a jagged edge. After the broad leather comb has done its work, the finer steel comb is used for cutting and breaking up the colour. The lines in graining are always irregular. A small comb is used for dividing the hairs of the over-grainers, though the workman often prefers to use his fingers. Over-grainers are made in several varieties—such as the castellated, the knotted, and the flat hog-hair—some workmen preferring one kind, and some another. Mottlers differ from over-grainers in the thickness of the hair; over-grainers are comparatively thin, whilst mottlers are thick, and for some purposes a worn-down, stumpy mottler is the best. Some mottlere are made of camel-hair for maple graining, and have a bevelled edge, but they are generally made of hog-hair. For the fine wavy hair-line seen in bird's-eye maple, a sable tube over-grainer is used. In appearance it is like a number of long sable pencils that have been laid in a row with a space between each and fastened together; this over-grainer gives a number of fine lines at one etroke, and



Machine for Straightening Wire.

holes rather less than ½ in. diameter. Fix in the regulating screws and sliding blocks and studs, and sufficient of the regulating screws will protrude through the frame to allow of a washer being pinned on the end of each. To complete the machine, procure four grooved wheels to Fig. 5, and one to Fig. 6. Fasten the remaining three studs in the holes at A, B, and c (Fig. 2), putting a washer on each stud. Place on the grooved pulleys with a washer outside, insert split pins in the studs, and the machine will be complete. The wire is drawn through the machine to straighten it, and all sizes, from No. 1 to No. 14 B.W.G., can be dealt with. For finer sizes, a machine half the size of the one here described would be suitable.

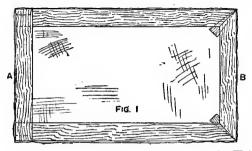
Tools for Graining.—A tool indispensable to the grainer is the badger, which is constantly in demand for blending and softening. The method of using 'the ist omake light strokes with the tips of the hair. Chamois washleather and soft rags are required for wiping out lights. For oak graining, combs of varying degrees of fineness are needed. These combs are made of steel, bone, leather, incharubber, or cork. The three last mentioned may be made by the grainer himself. A sound piece of stuff should be selected, about it in. thick and from 1 in. to 4 in. long, and the spaces to form the teeth, which should be of a suitable size, are cut with a sharp chisel or penknife, the teeth being shaped like the letter V and not less than in deep. In some of

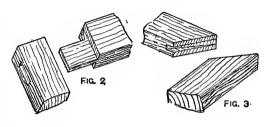
by holding the brush at different angles the distances between the lines may be varied. Flat hog-hair fitches (Nos. 2, 6, and 9) will be required for figuring; old fitches are also useful. It is hardly necessary to add that in order to get a variety of effects a variety of tools is indispensable. The marking in oak is often done by means of a piece of rag stretched tightly over the thumbnail; or a protection to the thumbnail can be made by softening in hot water a piece of guttapercha, which is then easily fitted to the thumb and, when dry, can be trimmed to the proper shape with a sharp knife. A ready-made veining horn is sold by colourmen. The objection to using these aids is that they are light to leave accumulations of colour on the edges of the markings. A square piece of guttapercha can be used to take out the lights; and a piece of rag, folded two or three times and then rolled, is useful to blur the markings so as to prevent a hard and cut-out effect preduced by the tool.

Determining Carrying Power of Small Balloons,—To ascertain what weight a small balloon will carry, inflate it to about two-thirds its capacity, and suspend a small bag of coppers, nails, sand, or shot from the net, and thus find how much the balloon will support without being quite able to rise. This will represent the maximum weight it will carry, and should be reduced to about two-thirds for the ultimate weight of the car and its contents.

Frames for Water-colour Canvases. — For art studies in crayon, sepla, water-colour, and pencil, where mathematical instruments are not used, a canvas frame possesses many advantages over the ordinary drawing-board that is generally used for the purpose. A frame is lighter to handle, and many prefer to work on the yielding surface of paper stretched on canvas rather than on the hard, unyielding surface afforded by a drawing-board. When the frames are used for water-colour drawings of value, the paper need not be removed from them, but the drawing may be placed in its permanent frame stretched over the canvas, and there will be no risk of damage in a second mounting. Dry pline is the best wood for making the frames. For "imperial" size (30 in. by 22 in.), the pleees may be 2½ in. wide by ½ in. thick finished; and for "half-imperial" size (22 in. by 15 in.), the rails and stiles may he 2 in. by § in., the wood for larger and smaller sizes than the above being strengthened or lightened in proportion. The corners of the frames may be secured by being halved together and nailed or screwed, mortised and tenoned, as at a (Fig. 1), the joint at one of the corners being shown in detail by Fig. 2; or they may be mitred and wedged, as at B (Fig. 1), each side of the mitre having a groove cut with the chisel, as at Fig. 5, into which wedges are inserted when the frame is put together. A piece of stout, unbleached calico should be stretched over the frame and tacked to the outside edges. In tacking on the calleo, commence in the corners the tacks at the points of the light, and lay the face, or the side on which the maker's water-

latter. When a fracture occurs (fractures being caused by the vibration to which every roof is subject, and by extremes of temperature), it is always the roof that separates from the fillet, and an opening for the admission of water is formed. Sometimes, especially during storms, water will penetrate a roof though the slates are perfectly sound; this is the result of lasufficient lap. If the roof is otherwise in good condition, it will be sufficient to strip a portion about 3 ft. square just over the spot where the water enters, and give an extra lap to the slates or tiles when replacing them. Should it be objected that such partial stripping of the roof will spoil its appearance, a plece of zinc, wide enough to cover the joint or joints where the water finds an inlet, may be inserted between the slates, the zinc being pushed upwards as far as the nails will allow; of course, the zinc must not come down below the bottom edge of the slate so as to be seen. The amount of lap to be given must depend on the pitch of the roof, the nature of the roof covering, and the local peculiarities of the climate. Should the amount of lap vary in the same roof, the lastgest lap should be given at the bottom, and the least at the top. The bond of the slates can only be kept properly by starting correctly. Slates should be trimmed to a uniform size, and the half-slate on the second course, to break the joint, should be exactly half the width of a whole slate. The practice of using small strips of slate for the undereaves, just breaking the joint by about 2 in., and leaving an open space, cannot be too greatly condemned, for it is at this point that the greatest volume of water collects. Such a leak does not often show itself on the ceiling, but soaks into the wall, on which, sooner or





Frames for Water-colour Canvases.

mark may be read the right way, on the frame. Now take a clean wetted sponge, and go over the back of the paper until when either of the corners is lifted it will fall limp; then turn the paper right side up, and wait until it has expanded to its greatest extent and has commenced to shrink again. Now turn the edges of the paper over the sides of the frame, and tack the paper on, working from the centres to the corners, as when stretching on the calico. Put the frame on one side in a horizontal position, with the paper uppermost, until the latter is dry, when it will be as tight as a drum. The frames should be made fully \(\frac{3}{4}\) in each way smaller than the standard sizes of paper, to allow sufficient margin for tacking on the outside edges; for instance, an imperial frame would measure 29\(\frac{1}{4}\) in.

Repairing Leaky Roofs.—The defects most generally met with in roofs that have ceased to be waterproof are cracked ffliets, caused by vibration; insufficient lep of the roof covering (the lap should increase as the pitch of the roof owing to the weakness of the roof important of the roof owing to the weakness of the roof important of the roof important of the roof important of the place where they are soldered, or at the angles); and choked gutters and broken slates. When a roof is to be repaired, the leaks should be located by measurements taken inside the house, using one of the walls or a window as a guide. If the source of the leak cannot be discovered in this way, a few slates must be taken off and the search renewed. Another plan is to allow water to trickle down the outside of the roof directly over the suspected place; by removing a few slates where the water has drained off, the weak spot will be plainly seen. It is generally at the angles that fractures occur, and nothing will be found so effectual a preventive as flashings all up the wall, or scakers. If scakers are used, they should he secured to the wall or to battens in order to keep them from slipping down. As a rule, the ordinary fillet cannot be depended on to keep out water; it is badly shaped, being triangular instead of rectangular, and clings to the wall rather than to the roof, the former being rougher and more rigid than the

later, it makes its presence known by ugly dark patches. The slates at the undereaves should fit as closely as at any other part of the roof. When a roof, owing to faulty construction, has become uneven on the surface, rafters must he firred up to strengthen and level it. Nothing is gained but much is lost by skimping the roof timbers, for a weak framework means a strain on the roof covering that necessitates constant repairs. To ascertain the position of a leak on a flat or in a gutter, careful measurements must first be taken inside the rooms, and the gutter must be cleared and washed out and wiped dry. A hole or crack in a zinc gutter shows as a dark line on the surface of the zinc. Fractures in lead are generally not so easily discovered, but they can be found by wiping the surface with a dry rag and watching carefully for the appearance of any damp spots caused by water ozing from the crack. Soldering should be avoided as much as possible. For leaks caused by broken slates and stopped-up gutters the remedy is obvious. Finally, it should be borne in mind that when a leak shows itself on a ceiling the rain does not always enter the roof just above it; very often the water travels some distance along the roof timbers before it finally drops on to the ceiling.

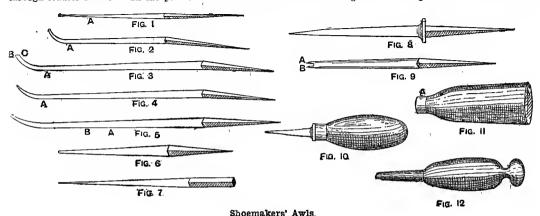
Hardening Milling-machine Cutters.—One method of hardening milling-machine cutters requires the use of a large, high fire, in which the cutter is buried. Only enough blast to bring the work to the required heat must be used, and the heat should be uniform throughout the cutter. If the piece has not been annealed, remove it when red hot from the fire, and allow it to cool off slowly until the red has entirely disappeared, when it can again be placed in the fire, slowly brought to the required heat, plunged in the bath of tepid water or brine, and worked round well until it stops "singing." At this point it should be removed and instantly plunged into the oil bath, and left there until it is cool, when the strain should be removed by bolding it over the fire until it is warm enough to snap when touched by the moistened finger. It can then be laid aside, and the temper drawn at leisure.

Copal.—Zanzibar copal or animi (there are two varieties, "recent" and "fossil") is the product of a tree, Trachylobium Hornemsnniamum, growing in Zanzibar and parts of Africa, and brought by the natives to Zanzibar, whence it is shipped. Sherra Leone copal is also an African product derived from the Copaifera Guibourtiana, and named after the port of shipment. Another resin, known as pebble copal, also comes from Sierra Leone, and is the product of the same or some similar tree. Angola copal is obtained not only from Angola, hut also from the Congo and other neighbouring parts. Gabion copal and Loango copal are two other varieties from districts in Africa Indicated by their names. West Indian copal is a soft variety of copal obtained from Brazil and other countries in South America; it is obtained from the Hymencea courbaril. Kauri may be distinguished from the true copals by being more nrittle and having a rather resinous odour when fractured; it is also easily softened by alcoliol and is quite soluble in ether, whereas the true copals are but very slightly affected by either of these solvents.

Awls used in Boot and Shoe Making.—The awls used in boot and shoe making are not of many shapes, but various sizes are necessary, and they may be obtained at as low a price as id. each or five for 2d. Before describing the various awls, some particulars may be given which will be of help in selecting an awl for a particular piece of work. Attention is directed to Figs. 1, 2, 3, and 4. The awls should never be put through leather further than the points A. The awl as

handle, somewhat like Fig. 11, but with a patent grip at A. It is used for pegged work, such as brown boots, in which the tops of the pegs are not to be blacked, but show up diamond shape. The peg awl (Fig. 8) has a shoulder which cannot be driven into the handle. When making peg-holes in leather which is too hard to be bored by hand, this awl is frammered. The awl illustrated by Fig. 9 is really a gauge. To make this, rub down both sides of a heel awl, broken at B (Fig. 5), on an emery-stick or a stone, so that the portion from a to B is tapered like a chisel; then, with a three-cornered fine file, split this up the centre, and finish off with a small flat kit file, so as to make two round, even points as at A and B. This is known as a pinpoint awl, or gauge, and is used for putting pinpoints, or blinders, into top pieces. Fig. 10 illustrates snother useful but home-made tool; it is used for French brads. As to the modes of using these ten awls, Fig. 1 is pushed straight through; Fig. 2 finds its own way, with a gentle, pushing wriggle of the hand; Fig. 3 is used for stitching; Fig. 4 works the same as Fig. 2, only, of course, a much harder push is required; Fig. 5 requires less wriggling and more force and a straighter push than does Fig. 4; Figs, 6, 7, and 8 are either pushed in by hand force or hammered in; and the awl shown by Fig. 9 is used in marking a row of blinders round a heel. All the holes can then he at equal distances apart.

Varieties of Stone Used for Paving.—The stones used for street pavements may be roughly classed in two divisions—granites and gritstones. Granites and



far as A should therefore be of the same thickness as the thread in use, which has to be pulled through double; or, in other words, the two ends of the thread have to be drawn through the hole made by the awl until the stitch is set, and so the solidity necessary in all good work is gained. Fig. 1 is a stabbing awl, used to close the tops of boots and shoes while held in the clams. It is also used in blind stabbing. It is a fine tapered awl with a sharp, flat point. Fig. 2 illustrates an awl used in closing flat seams, close patches. It is curved, flat at the point on the bottom side, and round on the top, as far as the curve extends. Fig. 3 is a curved stitching awl, and is known as a French or square awl. It is used in stitching the soles on to the welts in fair-stitch work. It is flat on each side from the point to a little past A. Its point is thin and forms a knifelike edge between B and C. The awl shown by Fig. 4 is similar to Fig. 2, but larger; both the bottom and top are somewhat round; it is used for sewing in the welts, and is called a sewing awl. Fig. 5 shows an awl used in sewing down the hels of sewn seats; it is not unlike the sewing awl, but it is larger and straighter. For all the above, the kind of handle used is like that shown in Fig. 12, but the size differs with the kind of awl. The smallest handle should be used with the awl shown by Fig. 5. In making way for rivets, brads, etc., the hole need not be so large as the rivet, say, going in it; for wood pegs the hole must not be so large as the peg is thick, but it must be quite as deep as the peg is long. Fig. 6 shows a peg awl. It is not wise to buy one, as sewing awls often break just about A, in Fig. 4, and when a little more is broken off and the end sharpened a serviceable peg awl is the result. It should be sharpened so as to he round at the top of the point and yet flat, with both sides round. The square peg awl, shown by Fig. 7, is generally used in an American patent awl

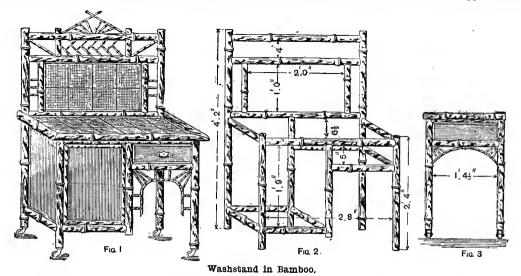
syenites, which are very similar in their properties to granites, have the merit of being very hard and durable, and are almost universally adopted for pavements where the traffic is very heavy. They have, however, the disadvantage of wearing to a smooth polish and becoming very slippery, as well as forming a very noisy pavement. The latter reason has led to their being displaced in some important thoroughfares by wood, which is comparatively noiseless, but much more costly, especially in maintenance. Amongst the many classes of granites need may be named the following: Aberdeen, Tyar Baggar (also from near Aberdeen), Guernsey, Penmaenmawr, Clee Hill, Port Nant, Port Madoc, Dalbeattle, and Irish granites from Newry and Bessbrook. Besides these, there are the syenites from the Markfield, Groby, and Mont Sorrel quarries in Leicestershire, Fogginton in Devonshire, and some Cornish stones. The Carnarvonshire syenites are dense and beavy, and form one of the very best paving materials. Aberdeen granite has been largely used in London, and that from Guernsey's held equally in favour by some authorities. As to the comparative merits of Welsh and Aberdeen setts there seems to be much conflict of opinion. The Welsh in Liverpool, Manchester, and the large manufacturing towns of Lancashire. A comparison of the relative durability of Guernsey and Aberdeen setts was afforded when Blackfrians Bridge was repaired in 1840. The paving had then been laid for thirteen years, and it was found that the Guernsey stones were only worn down in, while the Aberdeen stones were worn 1½ in. Some detailed to the slipperiness of various forme of paving in London, streets, and the number of accidents resultant. Observations were taken over fifty days for twelve hours each day. In one day of twelve hours 12,366 horses and

vehicles passed along Cheapside, and 5,350 along Cannon Street. During the fifty days 542 accidents took place on wood pavement, 719 on granite, and 1,066 on asphalt. From these figures, and the lengths of the various kinds of pavement under observation, it has been estimated that a horse can travel 330 miles on wood pavement during fifty days without meeting with an accident, 191 miles on granite, and 132 miles on asphalt.

Blistered Ceilings.—Where a plastered ceiling shortly after completion becomes blistered all over, the usual cause is that the lime used was not properly slaked, and probably contained large hard overburnt particles, which, slaking afterwards, expanded and caused bulges. Sitting the lime before using would have removed these particles, and the stuff should be made some considerable time before it is used, so that it may cool.

Tiled Washstand in Bamboo.—In building up the framework for the bamboo washstand shown in Fig. 1, the spindles at each side of the tiled back are let in (see Fig. 1), and the left front leg is cut and plugged for the door hinges. It is advisable to measure the eight tiles, as sometimes so-called 6-in. tiles really measure $6\frac{1}{6}$ in., which would make a difference of $\frac{1}{2}$ in. in the length and $\frac{1}{4}$ in. in the height of the tiled back panel. The two back panels, two sides (see Fig. 2), two

work; do not overdo it, however, as it can be thinned afterwards with hot water. When ready for use, the glue should be about the consistency of good body varnish. Fix the paper on to a fiat bench or board, and give one side of it a coat of the fish glue, taking care that the paper is completely covered. After the glue has set firm, apply a coat of good, quick-drying, clear copal varnish. When the varnish is thoroughly dry, the paper is ready for printing. It will now be seen that when the picture is stuck on there are a coat of varnish and a coat of glue between it and the wood, so that, with ordinary care, the picture is in no danger of being rubbed off when the paper is removed. Any kind of clean, firm-grained, light-coloured wood that contrasts very well with a black print will do to transfer upon. Planetree is the wood mostly used, and, as it works equally well in the turning lathe or under the plane, it can be thoroughly recommended for this kind of work. The article to be transferred upon, after being turned or otherwise finished, should be well smoothed with glasspaper, finishing with No. 0. It should then receive two coats of quick-drying, clear copal varnish. Before the second coat dries, the picture should be stuck on, and care must be taken not to finger-mark the varnish when doing so. After the varnish hardens the paper may be taken off. To do this, well soak the paper with warn water; the water softens the glue, and the paper can be seized by a corner and stripped off like



bottoms, partition, and top are all of ½-in. board, and a shelf of §-in. board is put in the cupboard, and the tiled back board is ½ in. thick. Plain old gold colour tiles match well with brown bamboo. When the panels are all in, and the top is on, the tiles are fixed with a cement made by mixing plaster-of-Paris in thin glue to the consistency of ordinary glue. The back tiles are also cemented on. The top is hooped with whole bamboo, and both top and back are beaded with black split cane. The drawer, bend, small work, and pediment are also finished, and the cupboard door is made like the small doors of the wardrobe. The cupboard is lined with leather paper, and both the side panels and the outside of the partition are covered and beaded. Finish all projecting ends with terminals, put on the castors and fittings, and when varnished the washstand is complete.

Transferring Pictures to Wood.—The prints used should be copperplate engravings, and they require to be printed on specially prepared paper. Ordinary prints are quite useless for transferring on to wood. The copperplate must not be engraved the same as for ordinary printing. The picture or inscription becomes reversed in printing; it becomes again reversed when it is transferred on to the wood; so the copperplate must be engraved to read the same way as the transfer will finally appear. The paper on which the transfers are printed should be very thin and pliable, so that it will not tear in bending to the contour of the article to be transferred upon. To prepare the paper for printing, break up some fish glue into small picces and put it into an earthenware dish; pour as much water on the glue as will make it rather thinner than for ordinary

the skin of an onion. All that now remains to be done is to lightly sponge off the glue, and finish the article with another cost of varnish. The varnishing and transferring should be done in an apartment where no other work is carried on which would be likely to cause dust or draughts. It is desirable that the room should be heated to about 80°; the heat enables the varnish to dry outside wand closes. quickly and glossy

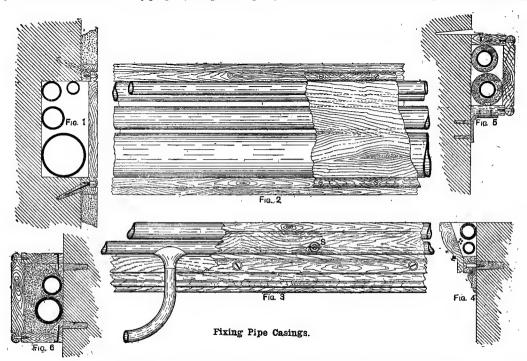
working Clay in Pits.—In the coal measures, and in other formations, there occur large bodies of clay, which are often worked underground. Usually, pits are run horizontally into the hill-sides from which the material is removed. The tunnels formed are in many cases so low that the hauling has to be performed by men who, in order to get along, have to bend double-fold over the clay-trucks. In other cases ponies are employed, and also hauling machinery. Often the hauling is done by the brickmaking machine. The getting of the clay is done by picking and shovelling, and where supports are required for the roof a cheap refuse sione from the stone quarries is built up in the form of pillars. The trucks used in removing the clay are run on rails to render the task of moving easy, and in works at a low level the trucks, after reaching the surface, are made to pass down an inclined plane, the loaded ones serving to draw the empty ones to the level of the pit mouth. The clay, having reached the works, is tipped out on to heaps, and exposed to the weather for some time. If possible, it is exposed to the action of frost, which helps to a great extent in the disintegration of the hard mass, rendering it more suitable for the subsequent treatment.

Fibrous Plaster Casts.—In making, say, a moulded cornice of fibrous plaster, the mould is first placed in position, and over it is fixed a wooden frame. Between the sides of this frame plaster-of-Paris is puddied. When half the required thickness has been spread, a coarse kind of sacking—jute fibre—is laid over it, and this in turn is buried beneath another layer of puddle. The plastic mixture dries very quickly, and by the time the cornice is finished it is getting pasty. In an hour it becomes quite dry. Fibrous plaster is light, durable, and pliable, and a sheet of it can be dropped on the floor without breaking it, whereas ordinary plaster would break when dropped. When the clay model has been completed, it is sent to the casting shop, where a cast is made in gelatine, and the plastic figure is moulded from that cast.

Fixing Pipe Casings.—Pipes (soil, gas, or water), whether exposed to view or cased, should always be placed in easily accessible positions. If they are let into chases cut into the wall, and plastered in, then, in the event of a leakage or stoppage, or should it be requisite to examine them for any purpose, this plastering

Figs. 5 and 6 show examples of casings for pipes fixed in such a position that they would be liable to become icebound in winter, unless they were padded, as shown, with a special kind of felt about \$\frac{1}{2}\$ in. thick, which is rolled and tied round the pipes before they are fixed. In Fig. 5 the bottom member is fixed to brackets secured to the wall, while the upper portion is attached to the wall by means of holdiasts. After the front is screwed on, the casing may be considered weather-proof; it also protects the enclosed pipes against the chance of accidental injury. Fig. 6 shows another method of casing pipes in a similar situation. Angle fillets are first fixed to piugs driven into the wall at proper distances apart, and the bottom and top members are then bradded or screwed to these fillets. Care must be taken not to get these angle fillets too large, lest they should touch the pipes. The vacant space in this instance is filled in with sawdust, or other frost-resisting material; the front being fixed with screws and cups as before.

Plumber's Wiped Joints and Copper-bit Joints,— Of these two kinds of joints, most certainly the wiped ioint is the better and the stronger. To make either



will have to be cut away, and the wall, and probably also the pipes, are almost sure to be damaged. The pipe casing should be so arranged that by the removal of a few screws the pipes may be thoroughly exposed to view. Fig. 1 shows a plan, and Fig. 2 a part elevation, of a pipe casing containing soil, waste, and supply pipes. A chase is left or cut in the brickwork, in size 9 in. by 4½ in., and rebated fillets, which are worked out of 2-in. by 1½-in. etuff, occupy a space equal to the thickness of the plastering; the panel, or front of the casing, is worked out of 11-in. by 1-in. stuff. The fillets are secured to the wall by being screwed to wood plugs driven anglewise into the brickwork, and the panel is beaded on both edges and screwed into the rebate of the fillets, cups being sunk into and flush with the face to that the casing can be taken down and refixed many times without injury. The elevation (Fig. 2) should be vertical to its plan, but is shown horizontal for convenience in grouping the figures. The casings shown in elevation by Fig. 3 and in section by Fig. 4 contain two pipes and some electric wires. The lower member is fixed to the wall by screws, engaging with wooden plugs driven into the wall, and the front portion or casing proper is fixed by ecrews in cups. The supply pipes to tanks penetrate the bottom members of the cornice; and, for operating the stopcock, the casing is plerced as shown at s. This pipe casing also serves as a cornice, which relieves the plainness of the walls.

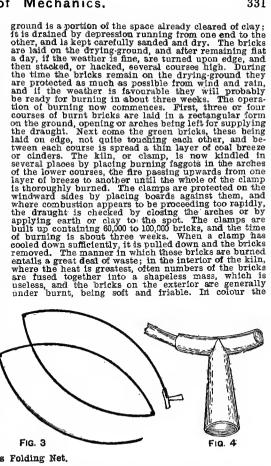
joint, the end of one pipe has to be opened for receiving the end of the other. The open end is reduced in thickness, and, when the joint is made with a copperbit, the outer edge only of the pipe is strengthened by the solder; the thinned part at the bottom of the cup or socket is not so strengthened. Hence the superiority of the wiped joint, in which the whole of the weakened parts are covered with a good thickness of solder. With service pipes, say, 2 in. or 3 in. in diameter and the lead 1 in. or 3 in. thick, sufficient heat could not be applied by means of a copper-bit to make a reliable joint, even when placed in a favourable position. A leaden jack pump put together, and the suction-pipe-joined on with copper-bit joints, would last but a short time. Even if the copper-bit joints were the stronger, it would be difficult to make them when the pipes are in their intended positions or when fixed horizontally. When copper-bits are used, each man requires a fire or stove near him, thus adding to the risk of setting fire to the building. When wiping is the practice, one fire is sufficient for heating several pots of solder, and the fire can be in an ont-building or where there would be little risk of injury. Small joints could probably be made with the copper-bit in a little less time than wiping, but for all-round work a skiful plumber would wipe joints as fast as hit them. It is only on small jobing works, where it is difficult to get a fire for heating a pot of solder, that the bit has an advantage in time.

Terms in Plasterers' Work: Counterlathing, Screeds, Rendering, Putty, Gauged Stuff.—Counterlathing is nailing short pieces of laths at 12-in. intervals across a beam or similar surface which comes in the way, so that lathing and plastering may be continued across it in the contrary direction without interrupting the key. Screeds are narrow portions of plastering, 6 in. or 7 in. wide and 4 it. to 10 it. apart, laid first, and carefully levelled as a guide for running the float over the remainder, which is put on more rapidly. Sometimes screeds are narrow battens of wrought deal, used for the same purpose. The name screed is also given to the portion of plaster or mortar behind a window or door frame. Rendering is the name given to the first coat of rough or coarse stuff in plastering when it is laid upon brickwork or masonry instead of upon laths. The term rendering is also used for Roman or Portland cement laid in the same way. Plasterer's putty is pure lime slaked with water, brought to a creamy consistence, strained through a hair steve, and allowed to evaporate until stiff enough for use. It is the last coat applied to internal walls that are to be coloured. Gauged stuff is plasterer's putty, with a portlon of plaster-of-Paris mixed with it, the proportions being 3 parts putty to 1 part plaster-of-Paris when required to set quickly, and gauged in small quantities.

Folding Net for Entomologist.—Assuming that the net is to be about 1 ft. in diameter, about 33 in. of wire will be required, the gauge of which should be 7 or 8; a size larger will add much to the strength and but little to the weight. Steel wire is by far the best, though brass and even from wires are used. Cut this into four pieces, and either now or later bend each into the quadrant of a circle. The illustrations will explain the construction. The joints usually made are similar to those on a rule. In Fig. 1 both pieces are together, the dotted lines indicating a rivet; in Fig. 2 they are separated. Three of these joints are required, as seen in Fig. 3, which

FIG. 1

FIG. 2



Entomologist's Folding Net.

shows the frame complete. One of the free ends of the wire is brazed into one of the arms of a brass Y, which, as seen in Fig. 4, consists of a piece of brass tubing, to the top of which is brazed another piece of tubing, cut underneath and then hent for common goods into a simple Y, or, for better goods, curved to correspond with the curve of the frame. When the frame is unfolded into a circle, the free end is simply pressed into the open arm of the Y. The bottom or leg of the Y forms the socket for the stick, and may either be left plain or be tapped to receive a screw fixed to the end of the stick.

Field Method of Making Bricks. — Brickmaking by the field method is largely carried on in open workings on the outskirts of most of England's large cities. The material used is a loamy clay, which occurs directly under the subsoil. The layer of soil is first removed, and the clay is then dug down, mixed with water, and made into heaps, which are then allowed to remain some time to temper. The clay-heaps are afterwards cut up with the spade, and well mixed and worked under-foot or by a wheel, all stones at the same time being removed. In some narts a simple pugmill is employed in working up the clay. The clay, being now to the moulder's bench, where it is made into dumps by the helper. Each dump of clay is rolled in sand and then handed to the moulder, who rapidly moulds a brick from it, and removes the excess of clay by means of a plane. The bricks are each turned out upon a piece of wood, called a pallet, and are removed by a boy to the heaking ground. When barrows are used for this purpose the bricks, each on a pallet, are placed on them, and the barrows, when loaded, are wheeled to the drying ground. One man and his helpers will produce 10,000 bricks per day. The moulds used are made of brass, of thin cast-iron, or of wood lined with sheetiren; they are wetted in a trough, and then sprinkled with sand before the clay is pressed in, this being done to prevent the brick sticking to the mould. The drying-

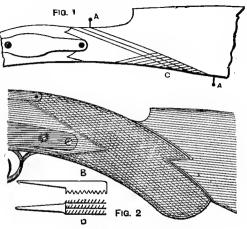
bricks vary from a pale yellow to a deep red or grey, and therefore they are more or less mottled. Many other defects might be mentioned. These bricks are, however, in great demand, because they are cheap. Modern houses are largely built of them.

nn great demand, because they are cheap. Modern houses are largely built of them.

Coloured Magic Lantern Sides.—To make coloured slides for use in the magic lantern, the simplest method is to paint with water colours, but to render the paint transparent a coat of white spirit of lime varnish must be applied, and when dry the picture is painted over again and varnished as before. Persons accustomed to oil painting preter the following method: Crush the paint employed for ordinary oil painting as finely as possible with a glass mulier on a piece of plate glass, adding copal varnish little by little. The colour can be employed immediately, or made in advance, and kept in bottles before use as transparent paint, but only the top part in the bottle is ufilised. The colours, if oily when taken out of the tubes in which they are sold, should be placed on blotting paper, which will absorb the oil; the colour will then mix better with varnish. The third method is to trace on the glass with lithographic ink worked dry in a cup and then diluted with spirit and some drops of copal varnish. When the lines are dry, the ordinary water colours (little tablets) are employed after being diluted with the following liquid: Water 20 parts, gum 4, sugar 2, with a few drops of phenic acid to prevent mouldiness; 44 drachms of white gum-lac dissolved in about 4 pt. of alcohol is used as varnish. The glass should be slightly warmed before the varnishing. When the side is covered with another glass, no varnish is needed. Only transparent colours—namely, Berlin blue, cochineal carmine, madder carmine, yellow lake, vegetable green, and burnt sienna—can be employed. For black use Indian ink or writing ink, or smoke-black mixed with slide varnish can be utilised. Special attention must be given to dust, for if it falls on the new paint it may make marks which have a very bad effect on the screen.

Repairing Riding Saddles.—In repairing riding saddles, the same principles are followed as for making new ones; as a rule, the back of the panel can remain with a new panel affixed, and also the hogskin facing. Remove all else, put in a new lining, and stuff like new. When a riding saddle tree is broken, a blacksmith will often repair it, especially when the plate is broken, but it must be stripped and everything put back as hefore. Sometimes a new tree is needed. Begin by taking off, the old top, doing as little damage to the flaps and skirts as possible. The skirts can often be utilised again like the flaps, so that only a tree seat and cantle cover will be needed. Make it up like a new one, and damp the skirts and flaps to make them easier to handle; also remove the old nails from the leather before employing new ones. If the skirts are gone, new ones must be cut out to the same pattern. Sometimes a saddle panel has to be stuffed and raised without lining; to do this, out a hole across at the centre, and fill each end with etuffing, afterwards levelling the etuff with the seat awl.

Chequering Gunstocks.—The part to be chequered is marked with pins driven into the stock, and a piece of thread is attached and drawn tight on the pins (see A, Fig. 1). The thread is then tapped lightly with a small hammer; this leaves a mark across the stock. A 4-in. three-square smooth file must then he run along the mark; the chequering tool B can then be used. After it is run up as far as required, it can be crossed as at c (Fig. 1), the pins and thread again being used



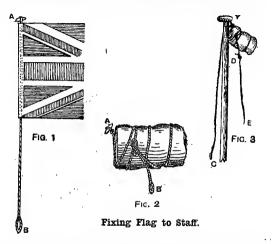
Chequering Gunstocks.

after running it both ways with the chequering tool. The lines must be run up with a chequering file, which is a small, three-square file with teeth cut on the edges; when chequering is finished, it should be similar to Fig. 2. The chequering tool B is made of steel with three rows of teeth, is \$\frac{1}{2}\$ in. wide, and \$\frac{1}{2}\$ in. long where the teeth are cut. The tang should be 4 in. long, tapered to drive into a handle. D shows the three rows of teeth.

Construction of Cow-houses.—The correct width of a cow-house should not be less than 16 ft., of which 2 ft. for its for forestull, 2 ft. 4 in. for manger, 6 ft. 2 in. for standing space for cowe, 1 ft. for the channel, and 4 ft. at the rear. The length depends upon the number of cows to be housed, but 4 ft. from centre of tie-up to the centre of next adjoining tie-up post is most suitable. The floor space allotted to each cow is thus 64 ft., and if the height is reckoned as 12 ft., nearly 800 cub. ft. of air space is obtained, which, in detached buildings on farms, is more than sufficient. The floor should be composed of a non-absorbent material; Staffordshire blue bricks are very suitable. They should be laid in cement and sand on a 6-in. bed of cement concrete. Pennant stone and limestone are often used as a pitching for the floors of cow-houses with very good results. An important point to be observed in laying floors of cow-houses is, that the standing space for cows should not exceed 6 ft. 2 in. from the manger front to the heel of the cow, or channel, and, also, that this floor should have very little fail, say 1 in. in 6 ft. The drop from this space to the channel should be 4 in. As the animal is prevented from lying in the gutter, it is kept comparatively clean. The drainage of the house is very simple, all that is necessary being a 12-in. channel, with one or

more outlets through an external wail discharging over a trapped gully leading to a cesspit or manure tank. The fittings required are a manger and crib, formed in the following manner: A pole-plate of 5½-in. by 3-in. stuff runs the whole length of the house; 4-in. rounded oak posts are fixed at 4-ft. centres, to which the pole-plate is secured by ½-in. bolts. The plate is 4-ft. high from the floor, and cow-ties, made of chain, work up and down the oak posts by means of a large ring. A 1½-in. elm board, 15 in. wide, is fixed to the back of the round posts, as previously mentioned, and forms the front of the manger. The back board of the manger is about 2 it. 6 in. wide, and is fixed against short oak posts, 4 in. by 4 in. in section. Both front and back boards are continuous in length; no divisions are required. The bottom of the manger is made of cement concrete, having a concaved surface. Ventilation is provided by means of louvred frames in the ridge, and inlets of short Tobins about 4 ft. from the ground.

Fixing Flag to Staff.—To fix a flag to a flagstaff, a piece of sashcord, 3 ft. longer than the depth of the flag, is fitted with a toggle A (Fig. 1) at one end and an eye splice B at the other. This is attached to the flag as in Fig. 1 by a strip of duck or calico sewn to the bunting as a broad hem round the cord. The flag or flags to be hoisted are "made up" as in Fig. 2, the toggle left out clear, and the bunting rolled up; three or four turns are taken all round, and the bight pushed under two turns, over the latter, and under itself as shown. Flags and pendants are kept rolled up in this way ready for hoisting, their name or letter being printed on the canvas

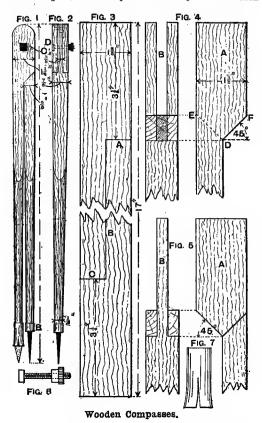


hem just under the toggle, so that it can be seen without unrolling. The signal halliards are rove through the truck T (Fig. 3), and have an eye spilce to slip over the toggle A (see Fig. 2); the other end of the halliards is tied to the eye B (see Fig. 2) with a "double sheet bend," and the fiag holsted in readiness; the end c is belayed, and when desired a slight jerk on the end E "breaks" the fiag.

Treating Candle Wicks,—Candle wicks have always been given much attention in candle manufacture. The wick must be placed in the centre of the candle, or it will remain too long, produce smoke, and darken the flame; though if the upper end remains exactly in the centre the air will not reach it, and the wick will carbonise and form a "thie!" or "waster." which, falling into a cavity in the top of the candle, will make, the latter gutter, and end by obstructing the wick. It then becomes necessary to snuff it. In order to do away with this inconvenience, Gay-Lussac and Chevreul, in 1825, recommended the use of flat or cylindrical wicks of an uneven texture having the property of curving over. In the same year, Cambaceres proposed the use of hollow, platted wicks, which, in measure as the candle burned, had the property of curving towards the white part of the flame. But ashes, nevertheless, formed, and, obstructing the wick, affected the light. In 1826, de Milly solved the problem by impregnating the wick with boric acid, which, uniting with the ashes of the wick, gives rise to a fusible body, which is rejected in the form of a drop or bead towards the extremity of the wick. In Austria, wicks are impregnated with phosphate of ammonia, which gives practically the same results. Finally, Balley has proposed a solution of salammoniac having a density of 2° or 3° Baumé.

Drying Acetylene Gas.—If acetylene gas can be made as cold as possible without having contact with water, it will be normally dry, and to cool it it is necessary only to let the gas pass through a coli of pipe which rests in a tank of cold water. A better and cheaper way is to pass the gas through a metal box or vessel filled with moderately small clean coke. Another way is to use a filter pad or screen of cotton-wool, and still another is to pass the gas through unslaked lime. The latter is highly effectual, but the lime soon becomes slaked and moist, involving rather frequent renewal. Cotton-wool arrests water from gas and air, but becomes clogged and matted rather quickly, and if allowed to get dry when in this dirty state it does not become clear and loose again.

Compasses for Use on the Blackboard.—Procure a piece of straight-grained Honduras managany, 17 in. by 1½ in. by 1 in.; plane it up square and true to 1¾ in. wide and ¾ in. thick. Square a line 3½ in. from each



end across one edge and down one side, as shown at A and C (Fig. 3). Gauge a line from A to C, as shown at B (Fig. 3). With a fine saw, cnt across the alternate edges down the lines A and C (Fig. 3), and with a bow-saw cut along the gauge line to meet these two cuts, thus dividing the piece for the two legs. From the point D (Fig. 4), which shows the top of one leg, set off lines at about 45° to right and left on both pieces, and square lines along the two edges from E and F. Set a mortise gauge to suit a \(\frac{3}{2} \)-in. chisel, and gauge from the point E up over the top and down to the point F on each piece. Cut carefully down the gauge lines so as to form a saddle and bridle joint. The experance of the two pieces should now be as shown at A and B (Figs. 4 and 5). See that they form a correct fit, easing the shoulders, if necessary, with the chisel. Taper each leg from \(\frac{3}{2} \) in. Square at the bottom. Now round each leg to within 6 in. from the shoulder. Fit together closely, and \(1\frac{1}{2} \) in. from the end c (Fig. 1) drill a small hole to fit a binding screw similar to that shown at Fig. 6. This will be found much better than the ordinary butterfly nut, as it does not come in the way of the fingers. Square the head of the binding screw, and eink it flush with the wood (see D, Fig. 1). This

will stop the screw from turning when tightening the legs with the milled head nut. Round off the top to form a semicircle, with the hole for the binding screw as centre. Plane all square and true, clean up with glasspaper, and finally polish. Next take two pieces of brass tube ½ in. outside measurement, one piece ½ in. in length, the other ½ in., and snother ¾ in. in length to fit loosely over the ½-in. piece. Cut the ½-in. length down both sides to within ½ in. from the end, and slightly open the cuts (see Fig. 7). Fit the pieces of tube one on each leg of the compasses. For a point, use a bradawi filed or ground to a round taper point.

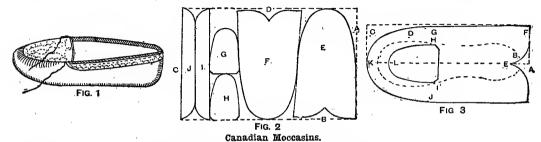
sides to within \(\frac{h}\) in from the end, and slightly open the cuts (see Fig. 7). Fit the pleces of tube one on each leg of the compasses. For a point, use a bradawl filed or ground to a round taper point.

Browning Twist or Figured Gun-barrels.—Browning gun-barrels is simple enough, although requiring great care, though it is a somewhat dirly and by no means pleasant process. On no account must anything of a greaxy nature come in contact with the harrels during the process; even one's hands should be carefully washed. The browning mixture can he concocted without the aid of a chemist. A measuring glass can be bought for 6d., marked from \(\frac{d}\) dr. to 2 oz.—quite sufficient for anything that is required; and if a pair of scales are not handy, the blue vitriol and murlate of mercury can be purchased of the required weight. The appliances required are a small puantity of whiting; also, if possible, a scratch-brush, though if this cannot be obtained a piece of scratch-card can be used instead. The browning mixture is as follows: I oz. of murlate tincture of steel, I oz. of spirit of wine, \(\frac{1}{2}\) oz. of murlate incture of steel, I oz. of spirit of wine, \(\frac{1}{2}\) oz. of murlate incture of steel, I oz. of spirit of wine, \(\frac{1}{2}\) oz. of murlate incture of steel, I oz. of spirit of wine, \(\frac{1}{2}\) oz. of murlate concreted will last for a considerable time. In mixing the ingredients the native acid should be put in the bottle first, and half the required quantity of water added; the other ingredients can then follow, the balance of the water being put in lest, and as soon as the mixture is dissolved it is ready for use. To prepare the barrels for browning they must be made bright with such yellows of the resent article. To clean the top and bottom ribs, shape a fiat plece of cork to fit them, cover the edges of the ribs. As soon as the barrels are polished they must be wiped down with a cloth, after which they can be repeated alternately at the muzyle and preces must be pur

Baths for Steel Hardening.—The commonest hardening bath is clear, cold water, though many workers use salt and water or brine. For obtaining extreme hardness, a solution of 1 lb. of citric acid crystals in 1 gal. of water has been found satisfactory. For very thin articles a bath of oil is necessary. For hardening springs sperm oil is very satisfactory, and for hardening cutting tools raw linseed oil. Many successful hardeners use water that has been boiled. Further, small, odd-shaped pieces are not so liable to crack or to harden unevenly when the water in which they are dipped for cooling is slightly warmed.

Canadian Moccasins.—A pair of size 6 Canadian moccasins, shown by Fig. 1, will need a piece of any light leather, 1 ft. 6½ in. by 1 ft., as shown by the lines A, B, C, and D (Fig. 2). Enclosed are E and F, the two bottoms and sides; G and H, the two front pieces; and 1 and 1, the quarter laps. To make patterns for the bottom sides, fold a piece of paper, 11½ in. long and 6½ in. wide, down the centre lengthwise, to obtain the top part of Fig. 3, shown there by the dotted lines. From A cut a round corner, as shown by B, starting about 1½ in. along the fold and finishing at about the same distance up the double edge, then cut off the double corner C, D being about 5 in. up. When the paper is opened this gives the main pattern. The front pieces can be cut in a similar way, with a fold down the centre; they are 4½ in. long and 2½ in. at the widest part, and about ½ in. of this forms the tongue. The two quarter laps are 1 ft. by 1½ in., with the corners rounded off. Two pieces of each kind must be cut, one for each foot, making six pleces in all. If the front pieces and quarter laps are beaded, or have fancy stitching, the appearance is improved. The llning is a matter of fancy; linen, swansdown, or soft leather may be used, and can be sewn in with the outer portions. To make a moccasin, place one of the largest pieces, face down, on a board; fold it up the centre, like the pattern, and sew it up the back from E to F (Fig. 3). Rub the seam down smooth; place it on the board again in the same way, and put one of the front pieces on, face upwards, as shown by H I L (Fig. 3). Secure the corner H by a citich or two to G, and I to J; likewise k to L. Now, as the large semioircular portion J K G has to be sewn to H I L, it must be puckered in a lot, the wrinkles being put in as regular as possible with the greater portion

To wall in the face, and keep the plaster within bounds, towels are rolled up and placed about it. In determining how far the mould is to extend, it has to be borne in mind that so much only can be included as will "leave" readily. More latitude is to be allowed in dealing with flesh, which is yielding, than in moulding from a rigid substance; but bone will not give way. The line will have to pass in front of the ears, and; if it is carried higher up the forehead than the beginning of the hair, the hair must be smoothly brushed down, and, of course, well scaped: The water for mixing the plaster of the inner mould is tinged with colour, as in ordinary waste moulding, and it is also warmed. Cold plaster ponred over the face would add to the discomfort of the person operated on; the sudden chill might also cause the nerves to twitch and the muscles to contract, and thus interfere with the proper expression of the features. The eyes and mouth have, of course, to be kept shut. Respiration will be carried on through the nostrils; most moulders put quills in them for this purpose, though a skifful operator can keep passages open by using a spatula. It is absolutely essential that the subject keep perfectly still till the plaster is set. It is well to make the inner mould somewhat thicker than in ordinary waste moulding. The outer mould should also be made tolerably stout. The few minutes which must elapse whilst the mould hardens are trying ones for the subject, and he will be impatient to have it removed; but it must be allowed to set thoroughly, and the removal must be done carefully and tenderly. A few small hairs are certain to become entangled in the plaster, and these must be managed with delicacy. The success of the whole operation must not now be imperilled by undue hurry. Taking a mould from the face of a dead



towards the end of the toe, as shown by Fig. 1. A good way to do this is to whip K G and also K J over with a stout thread. This is done by setting the stitches about as long again as those to be set in the front, always putting the needle through from the same side, and drawing the thread very tight where most wrinkles are wanted. These two circular portions are then sewn to the corresponding ones on the front piece. The piece I or J is then whipped round the top which is afterwards bound with a cord or ribbon running through it, as shown in Fig. 1, to be tied in the front as a bow. The dotted lines H, I, and B (Fig. 3) give an idea as to the part of the leather to be formed into a sole. If the shoes are wanted of better quality, say with all the edges skived and turned in, then, of course, an extra piece must be left on all round where this is to be done.

Taking Plaster Casts from Life.—The methods employed for taking plaster casts of the face or other parts of the human body are as follows. In the days when clean shaving was general, it was more easy to take casts of faces than it is at present, as luxuriant whiskers and a flowing beard cannot be reproduced by this process. Females and boys are the most satisfactory subjects, though the actual features of bearded men can, apart from the hair, be east with absolute fidelity. The person whose "musk"—as the face is technically called—is to be moulded has either to lie flat, face upwards, or to eit with the head well thrown back on a pillow. So much of the skin as will come in contact with the plaster is slightly rubbed over with olive oil, and all hair within the limits of the mould is securely plastered down with soap. Soap is better for the purpose than grease of any kind, as it is less liable to melt under the heat generated in the setting of the plaster. If any hair were allowed to remain loose, it would probably become embedded in the mould, and cause trouble. Although perhaps eyebrows and moustaches may not suffer greatly in appearance under this treatment, beards and whiskers, when plastered down to the skin, altogether lose their normal look; still, on the other hand, something is gained in showing the forms of the lower part of the face, which are ordinarily hidden.

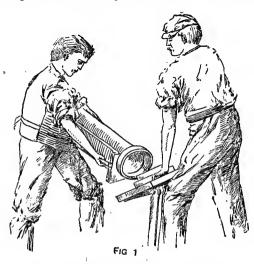
subject, though a melancholy task, is an easier one than moulding from the life. There is no danger of involuntary motions or changes in the features; no provision needs to be made for respiration, and the moulder can go about his work leisurely. A simpler part of the figure to mould, and a pleasanter to have moulded, is the hand. Many eminent persons have had casts taken of their hands—those of the Brownings, husband and wife, clasped together, are well known. Frequently all that is desired is one side of the hand only, as it may appear when lying on a cushion, and this can be moulded in a single piece. Oil is rubbed over it, especially round and under the nalls, and it is laid on a pillow, which may be covered with soft paper. The swellings of the pillow can be so arranged as to fill up most of those under parts which the mould would not "leave." A towel rolled round the arm will limit the mould in that direction. After the plaster has set, the hand, with the mould upon it, can be lifted bodily from the pillow, and any edges or tongues of plaster which hinder the pulling out of the hand pared away. When the cast of the hand is wanted in the "round"—that is, when both sides are to be completely shown—it can be laid upon sand; more sand can be packed round it till only so much is left exposed as will allow a mould from it to leave in a single piece. The exposed half is then moulded; the hand and mould are turned over bodily, and the edges of the mould are trimmed, keyholed, and clay-watered, after the usual manner of waste-moulding in two pieces. The second half is then moulded. A foot, leg, or arm may be treated in the same way; but moulding the entire trunk of a living person is not so simple a matter, owing to the constant swelling and falling of the chest in respiration. Few, however, are likely to be ambitious of moulding the entire torso.

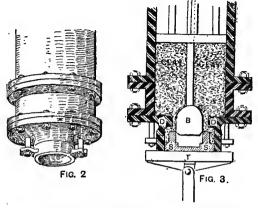
Fitting Large Cork to Small Bottle.—To make a farse cork fit a small bottle. It is the comment of the same way in the entire trunk of a living person and sare cork fit

Fitting Large Cork to Small Bottle.—To make a large cork fit a small bottle, it is the common practice to trim the sides of the cork. Often the knife is dull, and the cut irregular. A simpler way is to cut a wedge-shaped piece out of the cork across its lower end. If the cork is very large, cut out an additional wedge at right angles to the first.

Compo Work or Cement Rendering.—To ensure a estisfactory result in cementing a building, attention should be paid to the selection and preparation of the eatisfactory result in cementing a building, attention should be paid to the selection and preparation of the materials to be employed. For Portland cement compowhich is practically the only kind in use, the sand must be sharp or gritty, and free from any loam or olayey matter. Pit sand, as a rule, is not good enough for cementing; river sand, or the drift sand from roads that are repaired with either granite or flint, is much to be preferred. Drift sand, or road drift, is procurable in nearly every district, and is first class stuff if washed clean from all earthy and vegetable matter. Expose the cement to the air on a dry floor, and turn it over several times before it is used, as a great many fallures in cementing are due to the cement being used too fresh and hot, thus causing the work to blow and orack. Where time will allow, it is better to erect an independent scaffold, so as to do away with the necessity of cutting putlog holes in the work. If the brickwork has been pointed, all the joints must be well raked out, and brushed clean. The brickwork must also be well wetted with clean water as the work proceeds, to allow the cement to set properly and to stop excessive suction. Cement rendering is done in two coats: the first is called the flanking in or roughing-in coat, and the second the fining coat. The building must be first flanked in all the cement will not thoroughly mix with it. The suction of the roughing-in coat must be stopped by a liberal application of clean water, but care must be taken not to everdo it, and before the work is wetted a dry hrush should be passed over it to remove dust from the

Manufacture of Earthenware Sanitary Pipes.—
The process by which pipes are made is by no means complicated. Fig. 1 is an illustration of a pipe newly made and being taken away from the machine. The clay is thrown into a cylinder from above, and a piston, acting by steam power, forces the clay out at the end shown in the illustration. In the centre of this cylinder is a stationary rod, to which is fixed a piece of metal called a bell, which is shown at B in Fig. 3. This bell is the part that forms the inside diameter of the pipe, and must be made detachable so that whatever size the the part that forms the inside diameter of the pipe, and must be made detachable, so that, whatever size the pipe has to be made, whether 4 in., 6 in., 9 in., or 12 in., a bell of corresponding size can be adjusted. The method of forming the socket or collar of the pipe is also shown in the same illustration, in which D is the die forming the outside measurement of the pipe, and T the table, on which is fixed a wooden block s, which makes the inside of the socket. The table T (Fig. 3) is raised and lowered by means of weights something after

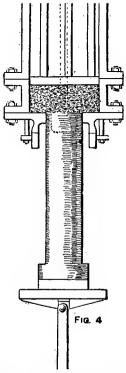




Manufacture of Earthenware Sanitary Pipes.

over, that is, presuming the building is to be done as a whole, not, as is frequently the case, finished in sections; and as a satisfactory result greatly depends on the flanking coat, more attention than usual should be gauged at the rate of 3 of sand passed through a sleve of 1-in. mesh to 1 of cement, and it is advisable to do the gauging in comparatively small quantities, and in the chade, as otherwise the stuff is partly killed before it is all used. Fix a rule straight and plumb from the top to the bottom of all external angles of the building and drive nails top and bottom at the opposite sides where no external angle may occur; then if a chalk line is strained from rule to nails, the line for all reveal rules and screeds will be obtained. If the grit is fairly coarse, a sufficient key for the next coat will be formed in ruling off; if not, a coarse drag or nail may be employed to form a key. Pass the floating rule over the work before the stuff gets too dry, or it leaves the face too open, causing excessive suction when finishing, and this must be avoided by all possible means. causing excessive suction when finishing, and this must be avoided by all possible means. All mouldings, mitres, returns, and weatherings of mouldings having been completed, working from top to bottom so as to commence finishing from the top of the building, the fining or finishing coat will next engage attention. This is composed of the cleanest sand obtainable, washed through a very fine sieve, of at least twenty or more meshes to the lineal inch. Previous to gauging it, pass all cement through the same sieve to remove all lumps. Where a light stone colour is desired, sliver sand is very good, but does not make such hard work as the road grit; and, heing expensive, silver sand is sometimes mixed with local sand in varying proportions, say half and half, or two or three local to one of silver sand. It is best to well mix a quantity dry, and to gange from the bulk, as if mixed in small quantities the colour may vary. Fining stuff is generally gauged at the rate of 2 of sand to 1 of cement, and the sand must be dry or the manner of a window-sash. When the cylinder is filled with clay and the piston has been brought to bear on it, the table sinks down, supporting the weight of the newly made pipe (see Fig. 4). When a sufficient length of piping has been forced out—usually 2 ft.—it is cut by means of a wire, then tipped on to a cradle as shown at Fig. 1, and carried off on this cradle to be set on the floor to dry. When thoroughly dry, the pipes are ready for the kiln. Before, however, they become too hard each pipe is carefully examined, straightened if necessary, cut to the exact length, and any defect rectified. The burning of the ware requires considerable skill and entails much responsibility. An indifferent workman may be the cause of heavy pecuniary loss, for, in many cases, the kiln under his charge contains goods representing a large amount of capital and labour, all of which may he wrecked through incompetent firing. The average number of fire-holes in a kiln is from ten to twelve, each of which must be regularly examined. The burning is maintained at a regular and progressive heat until the required temperature has been reached, when the heat is carefully allowed to fall off until cool. At no time must the heat be increased too rapidly, or allowed to fall away too suddenly, for a fluctuating temperature will leave its mark on hoth goods and glaze, and is the cause of much defective work. Clays, when subjected to heat, undergo, up to a certain point, a certain amount of shrinkage or contraction. After this they swell, and if a very high temperature is maintained they will darken in colour and finally vitrify. This shrinkage is simply due to the loss of moisture contained in the goods, and as this moisture is expelled the particles of clay are brought closer together and contraction follows. The amount of moisture is expelled the particles of clay are brought closer together and contraction follows. The amount of moisture is expelled the particles of clay are brought closer together and contraction follows. The amount

careful and steady firing cannot be over-estimated. The too rapid freeing of this moisture by attempting to force on the kiln may lead to disastrous results, as may be seen in fine cracks or small pieces burst off by the explosive violence of the steam generated. Most goods of this description are salt-glazed. The object of the glaze, whether salt or otherwise; is to protect the body of the ware and render it impervious to acids or liquids. Salt-glazing is particularly suitable, since to a slight extent it seems to enter into the body of the ware, and produces, moreover, so extremely fine a film that it would be impossible to chip off without breaking the goods, as might be done in certain cases where the glaze has been applied by dipping. The manner of salt-glazing does not require much explanation. When the kiln has reached its highest temperature the salt is applied by throwing a shovelful on each fire-hole. A shovelful of coal is then thrown on the top of this, and in about an hour the process is repeated, and again repeated till there has been perhaps four applications of salt. Meanwhile, small pieces of ware, called "trials,"



Manufacture of Earthenware Sanitary Pines.

are taken out of the kiln to see if the glazing is going on satisfactorily. After the trials have shown that the glazing is satisfactory, the kiln receives another firing, and is then allowed to burn out and cool down, which may take from twenty-four to thirty-six hours. The sating of a kiln varies, however, in different places and with different clays, it being entirely a matter of experience to find out what is most adapted and will give the best results with any particular clay. As a rule, it does not take so long to burn a kiln containing goods made of buff or fire-clay as it does for one containing red clay. The fire-clay will stand a very much higher temperature than the red, and as a consequence the kiln may be forced on and the temperature brought to its maximum height more quickly and with less fear of damaging or discolouring the goods. At least twenty-four hours longer may be required for burning red bricks or red terra-cotta.

Plumber's Wiping Solder.—This is composed of 2 parts; by weight, of lead and 1 of tin, and plumber's fine solder is about equal parts of those two metals. Good composition tubing is made of nearly all tin, or an alloy of tin and lead in which the former metal is in excess. As, however, a great deal of composition tubing

is made out of old metals of which lead, tin, antimony, arsenic, and zinc form the alloy, it would be inadvisable to put such in the plumber's solder pot. Should it be done, the melting point of the solder would be raised, and in applying it to the lead to be joined together would probably partly melt it. Neither do the metals named alloy in a thorough manner, but partake more of the nature of a mixture in which the constituents partly separate when making the joints, and some, especially zinc, show as small bright lumps on the surface. Joints wiped with what is usually called poisoned metal are difficult to make, and almost invariably leak when on water service pipes, and the appearance of such joints is a dirty grey, instead of bright and clean as when good solder is used

Bases and Precipitating Agents used in the Preparation of Pigments from Coal-tar Agents.—
The bases used in preparing lakes or pigments from the coal-tar colouring matters are barytes, gypsum, whiting, china clay, and zinc white. The precipitating agents are tannic acids, tartar emetic, sulphate of alumina, lead acetate, barium chloride, aluminium acetate, and sulphate of iron; alkalies, such as ammonia or carbonate of soda, are also used as assistants when required for rendering solutions neutral or slightly alkaline.

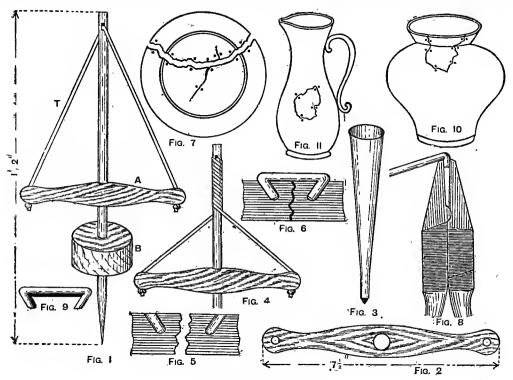
when required for rendering solutions neutral or slightly alkaline.

Definition of the Term "Oil."—Until recently the definition of the term "Oil" was not an easy matter. In the early days of chemical knowledge, the learned defined things more by their physical properties or outward appearance than by their composition; hence the term oil was applied to all unctuous or viscous liquids, including not only those bodies we now know as oils, but also sulphuric acid (oil of vitriol), petroleum or rock oil, coal-tar oil, etc. At present the term oil is applied to two groups of substances—the volatile or essential oils, such as those of lemon and bergamot, including also turpentine, distil unchanged on heating, hence their name; and as they mostly belong to one distinct group of chemical substances, one of the groups of hydrocarbons (that is, compounds containing carbon and hydrogen only) having the same or a similar composition to turpentine (CoHigh, they are now generally called "terpenes." The so-called oils of petroleum, coal-tar, etc., belong to other groups of hydrocarbons, and air not true oils. The stem oil is reserved for the fixed or fatty oils, which contain carbon, hydrogen, and oxygen, and decompose when heated to a high temperature, and these oils are linked together by the fact that they all contain the radicle of glycerine, "glyceryl" (CoHis), combined with three molecules of a fatty acid, hence they are called triglycerides. The fatty oils are not necessarily composed of one glyceride alone, but usually two, three, or even four glycerides are found to be present in each oil, and it is to the preponderance of particular glycerides that the differences in oils may be traced; non-drying oils consist principally of olein (CoHighas Oils), the glyceride of olei acid; drying oils contain linolein (CyHighas and heave similarly when treated with different reagents. When heated oils decompose, acrolein, acid vapours, water, and hydrocarbons are evolved. Treated with superheated team, water is absorbed, and fatt

Cracking, Blowing, or Scaling Off in Plaster Work.—Cracking is caused by the shrinking of the timbers used in construction, by the unequal settlement of a building, and by the setting coat being gauged with too large a proportion of plaster-of-Paris. Blowing is caused by the presence in the plastering of portions of unslaked or only partly slaked lime. Scaling off is the result of plastering upon a surface with insufficient key, of plastering upon a dry surface, of allowing one coat of work to get too dry before the next cost is applied, or of using coarse stuff that does not contain a sufficient quantity of hair. Cracking could he largely avoided by using well-seasoned timber, and by properly counterlathing the faces of large timber surfaces. Blowing could be prevented by thoroughly slaking the lime, and allowing the putty proper time to cool before it is used. Scaling off could be avoided by obtaining a sufficient key for all the coats of plasterers' work, by damping all surfaces before plastering, and by mixing a sufficient quantity of hair with the coarse stuff.

Riveting Broken China.—Riveting is the most substantial way of repairing broken articles in china. The necessary drill is illustrated at Fig. 1. To construct it, a light steel spindle 1 ft. 2 in. long, pointed at one end, will be required for the stem. A hole must be drilled through the head of this spindle to take the tap T, which is also fastened to the ends of the wooden arm A. This arm is bored (see Fig. 2) so that it can easily pass up and down the spindle. A box or ebony collar B (Fig. 1) should also be turned 2½ in. In diameter by 1 in. thick, and a hole slightly smaller than the steel rod drilled through it, when the block is hammered tightly into position. This hola must be drilled accurately, or the drill will wobble, and for this reason the hole should be drilled halfway through from each side. A still better method is to knock the wood on the spindle, and then true it up in a lathe. The drill bits (Fig. 3) simply consist of tapering tin tubes with a diamond point cemented or soldered in one end. These tin tubes fit tightly over the cone epd of the drill

consist of the in. brass wire, with one side half filed away, so that a flat surface meets the article. Of course, the thickness of the wire employed depends on the character of the article to be repaired. In the case of plates and similar goods, always fix the rivets on the back, as then they cannot be seen. Fig. 6 shows the rivet in position after the repair is accomplished, and Fig. 7 represents the back of a broken plate, and illustrates how the rivets should be distributed. To make the rivets. first place one end of the filed wire in the mouth of a pair of pliers (see Fig. 8), and, on the nose of the tool, hammer the wire down a little past a right angle with the flat side. Then carefully measure where the second bend ought to be, cut off the surplus wire, and bend down the second end, as in Fig. 9. Each rivet should fit the hole so tightly as to require gentle knocking into position with a very light hammer, or it will spring into position if given a pull with the pliers. Take care that the ends of the rivets are not too long, as if this is the case they will not lie flat on the broken article.



Riveting Broken China.

proper, but it is not an easy matter to set the diamond fragments, or "sparks," in the tubes. The mouth of the tube should not be more than *i, in. in diameter, and should not commence to widen out into a cone under in. from the end. Some measure of success can be obtained with well-tempered steel drills, if fine diamond powder moistened with oil is used as a lubricant, but neat holes are rarely produced, and the surrounding glaze is frequently chipped off. To use the diamond drill, the spindle is twisted so that the tape winds itself round the stem, as illustrated in Fig. 4. When the arm is pressed downwards, the tape unwinds and causes the spindle to revolve; whilst, if the hand is raised again as the crucial moment, the tape will immediately coil round the stem in the opposite direction, and thus be ready for another downward thrust of the arm. The operator sits, and always works the apparatus with the right hand only, leaving the left hand free to hold the glass or china rigidly against the thigh of the left leg. Before using the drill, always dip the point in oil, and bore all holes in the articles about 1 in. from the edge, at an angle so that they incline slightly towards the breakage (see Fig. 5). The positions at which the holes are to be drilled should be very accurately marked. If the finger is held underneath the part which is being drilled, the warmth will indicate how far the bit is through the china. The clasps or rivets generally

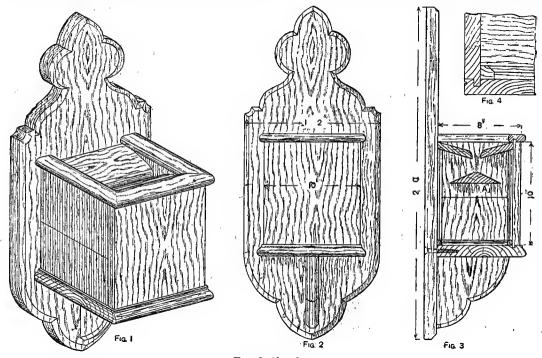
To complete the repair it is then only necessary to fill up the holes and cracks with plaster-of-Paris mixed with water to the consistency of cream, and left either white or coloured, according to the articles being mended. Finally, how vases, jugs, etc., are repaired is shown in Figs. 10 and 11.

Joining Golf Club Shafts to Heads.—Dogwood and persimmon are generally used for the wooden heads of golf clubs, and these woods come to the headmaker in blanks from the saw. A special machine cuts them down to a rough semblance of the head, but the remainder of the work must be done by hand tools, such as the chisel, file, and glasspaper. The shaft and head are spliced one to another by means of a strong cord, and about the joint is wound a fine waterproof cord, each strand fitting so closely and evenly that it seems part of the wood itself when the whipping is completed. The so-called iron clubs are composed almost entirely of steel, a mild grade of this material being best suited for the purpose. First quality heads are made entirely by hand, with hammer and anvil. Most of the metal heads, however, are drop forgings, and to this process is largely due the greatly reduced cost of golf clubs. All the heads, however, are finished on rapidly revolving polishing spindles, which remove all rough spots and produce the lustre of silver. lustre of silver.

Manganese Drying Oils.—Manganese drying oils are those in which compounds of manganese take the place of the lead driers usually added in the boiling of linseed oil. These drying oils are prepared by heating linseed oil in a steam-jacketed pan to a temperature of about 212° F.; the manganese compound is then added, and a current of air is blown through the oil with the arrived at the required consistency. The compounds of manganese usually added are the borate of manganese or the oleate or linoleate dissolved in twice their weight of turpentine, and the amount of the drier required to produce an active drying oil is only very small. The manganese drying oils differ from the ordinary boiled oils by being much paler; in fact, their colour is but little darker than that of raw linseed oil. They do not darken like the ordinary boiled oils containing lead driers.

Church Alms-box.—Fig. 1 is a general view of an alms-box for a church or chapel, Fig. 2 being a frent elevation and Fig. 3 a vertical section. If the top is in two pieces inclined towards one another, with an opening between them as shown in Fig. 3, the box

has to resemble its general form and proportions. The head and hands have, as a rule, to be modelled in clay, cast in plaster, and then fixed in their places; but work of any very elaborate or careful kind would not have to be put in; minor details would be omitted, and only that rough, bold effect aimed at which can be given quickly. Sometimes, with the help of pieces of thin board nafled to the frame and cut to shape so as to give something of the contour of the body, the draping can be done without any intermediate stuffing. This will most often be the case with statuary which is to show from one side only. At other times a rough stuffing, as of straw or shavings, confined by some kind of textile material tacked to the wood, is used to give the required roundness. Too much stuffing, however, does not help the effect of the drapery, which is the characteristic feature in this kind of work, real drapery being used. Calitoo, coarse or fine according to the requirements of the case, is first dipped in liquid plaster and then arranged on the figure. When the plaster seta, the drapery becomes hard and immovable, and will be the same to all jutents and purposes as if it had been modelled and cast. Taste and skill are needed in the



Church Alms-box.

allows two or three persons to drop in their offerings at the same time. The place A (Fig. 3) prevents anyone pushing in a rod with sticky stuff on the end to remove a coin. The lower part of the left-hand side is hinged for opening, and this door will require a lock, which may be screwed on inside, or a padlock with fancy staples may be used. The sides, front, and bottom should be grooved and tongued together, and the seeveral parts secured to the back with screws. To obviate screwing through the front and into the sides, a chamfered fillet may be glued in the internal angles, as shown at Figs. 3 and 4. Oak is suitable, but the box may be constructed of any other wood that matches the church furniture. The leading dimensions are figured in Figs. 2 and 3, and the thickness of the back, bottom, and bracket may be about 1 in., and of the other parts § in.

Imitation Sculpture for Temporary Decoration.—
The nations of Southern Europe have, in their outdoor decorations for great lestal occasions, a resource which is scarcely known in this country; it consists in the improvising of colossal statues and groups of sculpture. To these, though made of flimsy materials and raised in a few hours, they are able to give the dignity and apparent solidity of real statuary. A figure having been decided upon, a wooden framework is nailed together to support and form a kind of skeleton for it, which

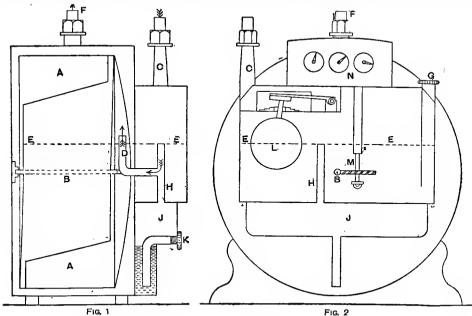
disposition of the folds, and the arrangement has to be made promptly or the plaster will set. But a novice may gain more time by mixing with his plaster-of-Paris some one of those substances which retard setting; size or glue will serve, and these will ultimately toughen the plaster rather than weaken it. Afterwards, fine whitewash—one or more coats as may be required—is brushed over the whole, drapery and modelling alike. The result will be that the statue, in appearance, is one which might have been carved from a solid block.

Adjusting Feed Wheels of Sewing Machine.
Feed wheels occasionally work irregularly—that is, make long and short stitches and occasionally stand quite atill. The action is somewhat complicated, and there are many causes for irregular feeding. However, in fitting feed wheels, see that they run perfectly free and yet have no perceivable play. A tight feed wheel puts extra strain on its driver, and leaves no exit for dirt. Feed wheels when worn may be recut. To do this, place them in a vice and use a three-cornered file or a half-round file with a flat ground on it. If the wheel is worn badly and requires levelling and grooving, place it in a lathe, file it level, and make a fine grooving tool out of a 4-in. flat file and groove the wheel carefully. Do not let it revolve too quickly. When filing the teeth, cut all the rows to the same depth.

, 1946

Wet and Dry Gas meters Compared.—Fig. 1 is a cross section and Fig. 2 a front view of a wet meter. The reference letters, which bear the same meaning in each figure, are thus explained: A A indicates a hollow drum which revolves in an outer casing on the axis B. The drum is divided into four sections which radiate from the axis. Each of these sections is filled in rotation with gas passing through the pipe C into a box. from which it passes through the pipe D. E indicates

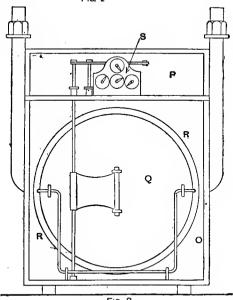
gradually drawn off. The water runs through a fine wire gauge on a revolving cylinder, leaving a thin coating of pulp behind. This is transferred to another rotating cylinder, where it accumulates until the desired thickness is attained. It is then cut and removed as sheets of millboard. To remove the moisture, the millboards are placed between sheets of zinc, and put under hydraulic pressure, being afterwards hung in drying rooms. Finally, they are again pressed, and



Wet and Dry Gas-meters.

the water-line, F the gas exit pipe leading to the burners, G a pipe with a screw cap for filling with water, H an overflow pipe for any excess of water to run into J, whence it can be drawn through the pipe with cap K, I a ball float which closes the valve above and stops the gas from passing when the quantity of water is too little, M a spindle, turned by the rotation of the axle B, and connected to the dials at N. With too little or too much water in the meter, the quantity of gas passing through is not properly registered. An objection to wet meters is the liability of the water to freeze, stopping the supply of gas. Water is sometimes carried with the gas, causing the flames at the burners to jump or flicker. In Fig. 3, which gives a front view of a dry gas meter, o indicates a tinned iron case with an upper chamber P, in which are the valves and gearing for the passage of the gas to and from the measuring chambers. These latter are in the lower part, and coustst of two fiat discs (one is shown at 0) of tinned from, with flexible leather sides at R. R. The back edges of the latter are fixed to a central vertical partition which divides the lower part of the meter into two. The diacs and leathers act similarly to a bellows, and alternately fill and empty. As the bellows fill; the gas in the chambers in which they work is expelled; and, as the bellows empty, the chamber re-fill. The capacities of the chamber being known, the quantity of the gas passing is registered by the dials s, which are turned by gearing attached to the discs, or moving parts of the bellows. Dry meters are now used in preference to wet meters, as they do not require so much attention, and contain no water to freeze. They should, however, be periodically tested, as they become defective by the constant wear of the leather and the liability of the latter to become hard and brittle by age.

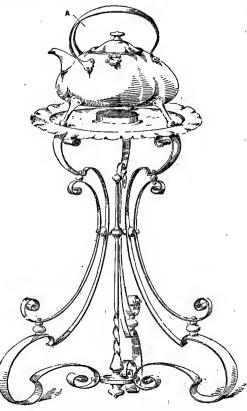
Manufacturing Asbestoe Millboard.—Asbestos millboard is made with short asbestos fibres, which after a certain preliminary treatment are run with water into the tanks of beating engines. Rotating beaters take up the fibre, open and draw it out, and then pass it forward to be soaked for a period until it again returns to the beater. Binding ingredients are then mixed with the fibre, and the pulp is placed in the vats of millboard and paper machines, where it remains to be



their edges trimmed. The chemical composition of the asbestos is scarcely affected by these processes, and beyond the necessary binding materials (about 5 per cent.) no adulterant is added by reputable English manufacturers.

Proportions of Babbitt's Metal.—Babbitt's metal consists roughly of four parts copper, eight parts antimony, and ninety-six parts tin. It is one of the best reducers of friction.

Tea-kettle and Stand in Copper and Wroughtiron.—The illustration gives a design for a five-o'clock tea-kettle and stand with spirit lamp, to be executed in wrought-iron and copper. The kettle is 7 in. in diameter, one spinning forming the top and sides, while the flat disc forms the bottom. The lid, of course, is spun, and has a hinge. The spout may be cut out of flat metal, and either brazed or knocked up to the shape illustrated, or it may simply be made stratght and the joint lapped. The three legs of the kettle are wrought from ½-in. round iron rod, and are riveted and soldered to the body. The handle is also of iron, and should be cut out of No. 16 s.w.6. sheet, and hollowed as shown. It should be split at the point A to allow room for the spout. This method of fixing the handle adds strength, lesides giving the kettle a quaint appearance. The tray is of No. 22 s.w.6. copper, worked up with the hammer. Besides being sunk after the ordinary fashion of trays,



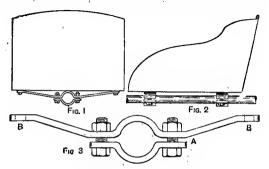
Tea-kettle and Stand.

it has a small well, 2§ in. in diameter and ¾ in. deep in the centre, to take the spirit lamp. This should be 2½ in. in diameter and 1 in. deep, and is provided with iron gauze at the top and packed with cotton-wool. The legs of the stand should be cut out of No. 16 s.w.g. iron beaten up with the hammer; for simplicity they may be made of §-in. by ½-in. strap iron, but then would not present such an uncommen appearance as when wrought. Before polishing the copper work, the kettle should be carefully tinned inside and thoroughly cleansed.

Rich, Poor, and Hydraulic Limes.—A rich lime is one in which the impurities do not exceed 5 per cent. of the whole mass; it is also called pure lime, and is chiefly employed for internal plastering; it is slaked by immersion in water, and may be run through a sieve into a bin; where it may be left to cool and to consolidate into a thick paste, when it is ready for use. Poor lime possesses much the same qualities as rich lime, but has a larger percentage of impurities (about 20 to 30 per cent.), and must be used with a smaller proportion of sand; it takes longer in slaking, and does not increase so much in bulk as the rich lime; it can be slaked in much the same way as rich lime. Hydraulic lime con-

tains, in addition to a certain amount of pure lime, such useful impurities as alumina and silica, which render the lime capable of setting without atmospheric influences. The amount of hydraulicity is calculated by the amount of these impurities. Hydraulic lime should be ground fine before use; it may be slaked in much the same way as Portiand cement, and it should be used as fast as it is slaked.

Child Carrler for Cycle.—A simple form of carrier to clip on the top tube of a cycle is illustrated by Figs. I and 2. As the vibration is likely to be considerable, and as the carrier is not suspended on springs, it should be carrierly padded in the seat and back, the seat padding being higher by I in. at the front than at the back, so that the jolting will not shake the child continually to the front or off the seat. To make the body, from a 9-in. by ½-in. pine or American whitewood board, planed on one side, cut out the bottom, back, and two sides to Figs. I and 2. The back is 9 in. high by I ft. broad, and the sides are 8½ in. high at the back by I ft. long on the bottom. The bottom piece is I ft. square. Chamfer the bottom edge of the back plece to the angle of the sides, and round off and smooth the top edges of the back and sides, fixing together with I½-in. screws, countersunk ½ in. below the surface. Putty up the screw heles and clean off with sandpaper ready for painting. Fix two brass studs, one on each side, for a broad strap to hold the child in place. For the clips on the top tube, about 2 ft. 3 in. of 1½-in.



Child Carrier for Cycle.

by \$\frac{1}{2}\$ in. iron will be required. Cut off two pieces 10 in. long, and two pieces 2\frac{1}{2}\$ in. long, and mark the centre of each piece. Bend the centre parts to go partly round a steel or iron mandrel of the size of the top tube, and held in the vice. When put together on the tube, there should be a space of \$\frac{1}{2}\$ in. A (Fig. 3) between the parts. Bend back the ends of the two short pieces as shown, and about \$\frac{3}{2}\$ in. of the two long pieces to correspond; then bend up the remainder so that the ends B fit flat on the bottom of the seat. Drill \$\frac{1}{2}\$-in. holes in the ends and in the centre of the flat part of the clips to take \$\frac{1}{2}\$ in. bolts, \$1\$ in. long, with hexagon or square heads. The holts that fasten the irons to the seat may be \$\frac{1}{2}\$ in. in diameter, with round heads, having squares under them to prevent turning when the nuts are screwed up. To secure each clip iron still further, a countersunk hole may be drilled in its centre, and a stout wood screw inserted. To prevent scratching the enamel of the cycle the clips may be lined with thin leather glued in place. Cleen up and paint to fancy. The dimensions given are for a child of two to three years of age.

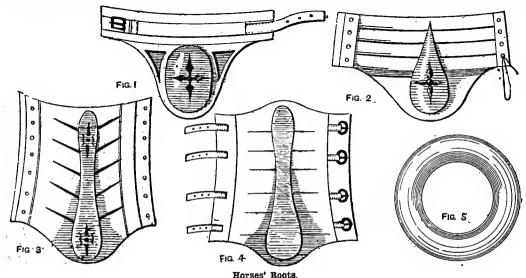
Material for Tow Fire and Gas Ralloons.—Small

Material for Toy Fire and Gas Balloons.—Small balloons may be made of strong tissue paper, if it be well varnished with a mixture consisting of 1 oz. of paraffin wax dissolved in 1 pt. of benzoline, to which 1 dr. of pure nuvuleanised indiarubber cut into small pieces is added. Stir all the time, and allow the whole to stand for a day or two, or until all the scraps of rubber have dissolved. China or Tussore silk, or taffeta or fine unprepared Scotch cambric, is, however, much more satisfactory. A better varnish may be made as follows: Dissolve 1 oz. of indiarubber in 1 qt. of drying oil by putting the whole in a closed tin or jar, and surrounding the vessel with boiling water; standing the tin or jar in a large vessel will accomplish this. If too thick, the solution may be thinned with more oil; it will dry in forty-eight hours after being laid on. A quicker-drying varnish may be prepared by dissolving, cold, in a closed vessel, ½ oz. of indiarubber in small pieces in 1 pt. of chlorotorm, ether, or bisulphurct of carbon; this dries at once.

Enlarging Horse's Collar.—To put a piece in a cellar to make it larger, first shave the ends of the forewale thin, and remove a few of the wisps. Cut a piece of leather of the same width as the leather in the forewale, and statich it, joining it well with the old leather, and shaving the joint thin. Put in some fresh wisps and a shert collar fron, one after the other, until the forewale is hard enough, taking care to join the straw well, so that there will be no hinge. The iron must be besten in with the straw on it by a mallet, as it cannot very well be knecked on the block. When leng enough, close the top, and, unless it is much enlarged, flock in the body will suffice to lengthen it. Stitch a plece of lining or basil to the new piece on the forewale, and iasten it in the shape of the body by stitching the other side; then stuff it tightly with flock. Jein the top and put a cap on the forewale, and a patch in the side piece of sufficient length to cever the new part.

Horses' Boots. — Fetleck boots for horses (Fig. 1) are made of leather, indiarubber, cloth, and leather, er, as in Curtis' patent, of zinc and leather, according to the part en which the horse catches itself. They can be bought in all varieties and patterns ready-made, tike perforated lace leggings, lace fetlock boot (Fig. 2), rell-cutting boot, top-rell fetlock boot, back sinew boot,

used. The rough lumber, having been delivered at the works, is peeled, split, and stacked to dry, after which the wood is sawn across the grain into 2-in, lengths, and the splints are cut from these blocks in a special planing machine, the cutting tool of which is a double row of circular knives, placed one above the other, each row centaining thirty-twe knives. As the tool makes 250 strekes per minute, the capacity of each machine is nearly 1,000,000 splints per hour, after allowing for time taken in picking up fresh blocks, the machine being hand-fed. The splints are dried by hot air and then gathered up by boys, who put them in the hopper of a cleaning machine which separates all fragments and slivers. This cleaning machine is a device for delivering table, whose surface has a number of parallel grooves running in the direction of escillation. At intervals of a few inches transverse slets are cut entirely through the table. The splints travel down the table and fall into a receptacle below, while the slivers and broken fragments fall through the slots. In a straightening machine, the slots are shaken down until they are arranged side by side in long parallel rows, just as cordwood is arranged and stacked by the weodcutter. The machine is then stopped and the slots are drawn away, leaving the splints straightened out for further handling.



lace or buckle speedy-cut boot (Figs. 3 and 4), ever-reach boot of indiarubber to slip on ever the heof, and indiarubber ring boot (Fig. 5), either solid or hellow. They should have a cup just like the knee-cap to cever the fetlock. A side leg boet, made for a horse that catches above the fetlock, must be cut to reach almost frem joint to joint, and is stiffened along the centre inside, and has three straps and buckles en the outside. Heof-swabs are made of felt or leather, the sole being cut the same shape as the hoof, and leather being placed round to cover the tep of the heof, fitting tightly and slanting upwards, and being fastened behind with a buckle and loop. Poultice boots are made exactly the same, but have a piece of strong canvas above to keep the poultice round the top of the hoof; each is fastened behind with strings at the top, and a strap with a buckle at the bottom.

Elastic and Highly Lustrous Varnishes.—The fellowing are German recipes for elastic but bright varnishes: (1) To 20 parts of shellac varnish add 1 part of Venice turpentine and from 4 to 8 parts of spike oil; colour by adding concentrated solution of suitable tardye stuff. (2) Dissolve 5 parts of resin, 6 parts of seandarach, 12 parts of shellac, and 5 parts of turpentine in 90 parts of alcohol (90 per cent.), filter, and colour with fine lampblack ground in apirit of wine.

Manufacture of Match Splints. — For the little sticks which carry the igniting material of ordinary lucifer matches, the raw material is a special grade of sawn lumber, chosen for its straight grain and freedom from knots. The grain must run parallel with the splint, which otherwise will enap in two when the match is struck. For cheapness, white-pine cerdwood has been

They are picked up and put in holders, these being boxes 4 in. deep, 2 in. wide, and 1 ft. 3 in. long. The holders are carried to the match-making machine, in which in one continuous operation dips the splints in paraffin wax, tips them with the igniting mixture, dries them, and delivers them, neatly arranged in parallel pipes, for convenience in packing into boxes.

Notes on Vnlcanite.—The best qualities of vulcanite show, when fractured, a lustre somewhat resembling that of jet, and the poorer the quality the lower the lustre. Although casy to machine, vulcanite is hard on tools, and in sawing, turning, planing, or milling, the best speed is that at which brass is machined. In milling there should be a free use of soap and water. Lubricants should not be used when turning or sawing.

Lubricators for Machinery.—To ensure the proper olling of rubbing parts of machines lubricators are used. The simplest form is the inverted bottle containing the oil and a tube which passes through the stopper of the bottle and rests on the shaft. When the shaft is at rest the oil cannot flow out, but when the shaft is at rest the oil escapes by adhering to it. Another simple lubricator consists of a reservoir of oil into which a wick dips and furnishes a steady supply of oil by capillary attraction. This form has the disadvantage that the oil escapes whether the shaft is running or at rest. For intermittent supplies of oil, cup lubricators are used; they consist of a reservoir having two cocks, one ahove and one below it. Opening the top one and keeping the lower one closed allows of the reservoir being filled, although the lubricator may be in connection with a cylinder or steam chest; closing or nearly closing the top one and opening the lower one allows oil to flow where required.

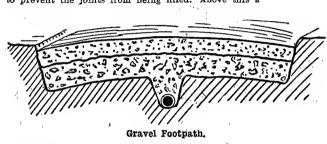
Harness Compositions.—Recipes for harness compositions are: (a) Glue, 4 oz.; gum arabic, 3 oz.; water, 3 pt. Dissoive all by heat and add of treadle 6 oz., and very finely powdered ivory black 5 oz., and slowly evaporate with constant trituration until the composition is of the proper consistency when cold. When nearly cold, bottle and cork; if necessary the bottle can be warmed before use. (b) Mutton suet 2 oz., and pure beeswax 6 oz. Melt this mixture and then add finely powdered sugar candy, 6 oz.; soft soap, 2 oz.; lampblack, 2 oz.; and finely powdered indigo, 3 oz. When perfectly incorporated add 3 pt. of oil of turpentine. Keep the composition in pots or tims. (c) Beeswax, 1 lb.; soft soap, 6 oz.; ivory black, 1 lb.; Prussian hlue (ground in), 1 oz.; linseed oil, 2 oz.; and oil of turpentine, 2 pt. Mix well together and pot. Put a thin layer of one of the above on the leather and polish gently with a brush or rubber.

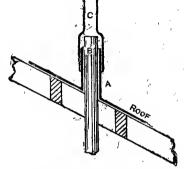
Forming Gravel Footpaths.—One of the most elementary forms of public footpath, suitable only for country districts where the traffic is very slight, is that formed by a layer of gravel, either with or without special foundations. Where the natural formation of the ground is sandy or gravelly, no special preparation may be necessary, but, in other cases, a foundation that will be sufficiently porous to drain away any water should be provided. Furnace clinker, ashes, broken brick, or other hard ballast, should be laid to a depth of 6 in. or 9 in., and in this, if it is wheled to have the path specially well drained, agricultural drain pipes may he embedded. The top coating of gravel should be from 4 in. to 6 in. in thickness, finished with fine screened gravel, mixed with a little loamy earth as a binding material, and well rolled. In constructing such paths, the drain pipes, having been laid at the bottom of the trench, should be covered over with sods of turi, laid with the grassy side downwards, or with small brushwood, to prevent the joints from being filled. Above this a

ceilings of some public buildings where a semi-opaque glass is wanted. Though paper pulp can be drawn out by modern machinery into the thinnest imaginable sheets, the toughness does not suffer, and thus thin paper table napkins and table-cloths are produced; some of these are nearly as tough as linen in resisting strempts at tearing, but they do not stand wetting. Paper vests, paper underclothing, and the paper linings of winter suits are prepared, and waterproof paper is made, but is hardly suitable for making up to replace linen for table use. Waterproof paper is sometimes glued to cloth, which in this way is rendered impervious to moisture. Experiments have been carried on for a long time with a view to freproofing paper, and partial success has been gained. Compressed paper chemically prepared is used as an electrical insulator. Paper is a good packing for perishable goods, and if it is waterproofed, butter, cheese, and similar products can be kept packed in it for longer than in any other material; the packing paper is made quite airtight. Every year, the drug trade uses thousands of tons of fine filter paper.

Biacking for Harness,—To make harness blacking, the ingredients necessary include molasses, 8 parts; lampblack, I part; sweet oil, I part; gum arable, I part; singlass, I part; and water, 32 parts. Mix well together and add one part of turpentine. Apply the mixture with a sponge. If it is hard, place the bottle in hot water to soften the mixture. A small quantity of spirit of wine can also be added when the mixture is cool.

Waterproof Joint for Stove-pipe.—To fix a stovepipe, so that the joint shall be waterproof where the pipe passes through a roof, the woodwork of the roof should be trimmed so that there may be no combustible





Waterproof Joint for Stove-pipe.

little earth is laid, then the ballast, and last of all the fine gravel. The illustration shows a section of gravel footpath more than I mile long, constructed in a public park. The path is 6 ft. in width. In this case the excavation to take the ballast is 1 ft. 3 in. in depth. The foundation is 9 in. in thickness, and is formed of broken bricks, coarse gravel, or other approved material, broken to pass through a 2½-in. gauge, and then well rolled with a horse roller weighing 15 cwt. The upper layer is 6 in. in thickness, formed of smaller gravel to ½-in. gauge, and well rolled with a 15-cwt. roller. A 3-in. openionted drain is laid along the centre of the whole length of the walk, below the bottom of the foundation, as shown in the illustration. Gravel paths are sometimes tarred over when thoroughly consolidated. This must be done only when the weather is quite settled and fine, as the least rain will spoil the operation.

Stains for Saddlers.—Brown stain: Boil equal parts of pine and alder bark in six times their bulk of water until the colour is extracted, and when cold add a little alcohol. Yellow stain: Boil some fustic berries in alum water and darken the shade by adding powdered Brazil, which must be boiled with the berries. Brown, russet, and yellow stain: Boil a given amount of saffron in water until the colour is extracted, cut a quantity of annatto, putting it into urine, and mix the urine and extract, the proportion of each determining the shade; the greater the amount of annatto the darker the colour.

Uses of Paper.—Exceptional uses of paper include the following: Railway-carriage wheels made of compressed paper, and paper wheels in sizes ranging upwards from those used on roller skates. Water and sewer mains made of paper properly hardened and chemically treated are more impervious to water than are some of the iron and earthenware mains, but it remains to be seen whether they last longer. Paper window panes have been used, but do not admit much light; such panes can be used successfully for the

material within 9 in. of the stove-pipe. A sheet-iron slate A with a niece of pipe riveted on at the proper angle, and large enough to allow the stove-pipe to pass through it, should be made and galvanised, and fixed on the top of the roof, and the slates made good round it. The stove-pipe B is now brought through this funnel, projecting about 4 in. above it. The external part of the pipe c has a socket at the bottom, and this slips down over the funnel at A, and makes a good watertight joint, and the pipe is easily removed at any time for repairs or cleaning.

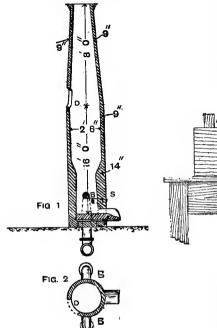
Fastening Parchment Paper to Polished Surfaces.—The following cement may be used for this purpose, but, when made, it should be kept in well-corked hottles: Maccrate in a small quantity of water in separate vessels 4 oz. of gum arabic and/1 oz. of gum tragacanth, and well stir the latter, when it gets swollen and softened, until it is homogeneous. Mix the two gums and filter the whole through linen, and then add elightly more than 1 gill of glycerine, into which 0.9 oz. of thymolhas been dissolved. Add water to bring the bulk of the whole up to about 13 pt.

Gine Size. — To prepare a good glue size, put about 4 oz. of best white glue into a tin vessel and just cover with cold water, and allow the glue to scak until it is so soft that the finger can be pressed through it; this will be in from three to four hours. Place the vessel in hot water, and when the glue has quite dissolved put a thumh and first finger into it, when it will be found that they cannot touch each other through the glue. Now slowly pour in warm water, stirring until one finger can be felt to resist the other, this being an indication that the size is of the right consistency for ordinary applications.

Waterproof Pastes for Carriage Harness.—Two waterproof pastes are made as follows: (a) Dissolve three sticks of black sealing-wax in \$\frac{1}{2}\$ pt. of alcohol or lac in alcohol and colour with lampblack. (b) Meit 2 oz. of black resin in a glazed vessel over the fire, and when this has dissolved add 3 oz. of beeswax, and as soon as all is melted remove from the fire and add \$\frac{1}{2}\$ oz. of fine lampblack and \$\frac{1}{2}\$ oz. of Prussian blue in powder. Stir all well and add enough turpentine to form a thin paste. Cool and apply with a sponge; polish with a soft brush.

Brass Polishing Paste.—Recipes for this are (a) Dissolvo 3 parts of oxalic acid in 40 of water, with 100 of pumicestone powdered, 2 of oil of turpentine, 12 of soft soap, and 12 of any fat oil. (b) Beat equal weights of soft soap and rottenstone into a paste.

Blast Furnace. The accompanying illustrations show sectional views of a blast furnace capable of dealing with from 12 to 20 tons of fron per day. It is built entirely of firebricks, and is of such a simple



Blast Furnace.

construction that no further explanation is needed. Fig. 1 shows a vertical section, and Fig. 2 a horizontal section of the furnace; and the letters indicate: B, blast; D, door; S, slag hole.

Grafting Wax.—A good composition for a grafting wax as used by gardeners when grafting fruit trees consists of equal proportions of resin, beeswax, and tallow, melted in a metal pot over a slow fire, thoroughly incorporated, allowed to cool, and used lukewarm. But unless the wax is to be used in larg quantities, it is much better to purchase it ready made. The French preparation, Lefort's mastic, is a good one, and may be used either hot or cold.

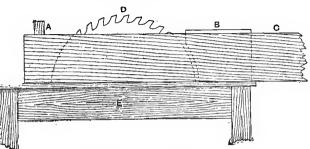
Removing Designs from China.—To remove burnedin designs from china without much injury to the glazing, rub the surface with a piece of pumice stone moistened with strong bydrochloric acid; or rub with a cloth, wrapped on a stick to protect the hands, and wetted with hydrochloric acid. Then wash the surface with a strong solution of sodium carbonate or bicarbonate, and rinse in clear water.

Bevelling Glass.—For bevelling glass the first requirement is a horizontal circular table which may be caused to revolve. Face plates are fitted to the table for rubbing, amoothing, and polishing. The glass to be bevelled is held by a support at the angle required for the hevel, and the edge of the glass is then brought

down upon the revolving table. For the first operation a cast-fron face-plate is fixed on the table, and the rubbing is performed with sand, or emery and water. When the bevel is nearly formed, finer enery or sand may be used. For the next operation of smoothing, the face-plate is changed for a glass one, and flour emery is used until the scratches are entirely removed. The bevel is then polished with a wood plate, covered with cloth, employing rouge for the purpose.

Saddlers' Black Wax.—Recipes are: (a) Pitch, 2 lb.; resin, 2\(\) lb.; seal oil, one pennyworth. In winter use 2 lb. of resin instead of 2\(\) lb., and never more than two-thirds of the oil until the stiffness of the wax has been tested. (b) Pitch, 1 lb.; resin, 1 lb.; and lineaed oil, one pennyworth. The exact amount of oil to be used depends on the season and the weather in both of the above recipes, and a little lampblack may be well mixed in when the wax is required very black. Always melt the pitch and resin together, and then add the oil. Afterwards pour the mixture into cold water, and knead and pull lb until it floats. Try a small lump first to ascertain whether there is sufficient oil, and likewise after pulling to see whether it floats.

Management of Circular Saw.—Here is some advice as to the management of a circular saw. Be careful not to overfeed the saw. If the saw is overfed, the timber is very apt to rise up the back of the saw and to be flung at the sawyer; the saw-plate may also become damaged. As the fitmber is being sawn, a wedge should be driven in the saw-kerf (as shown at A) in order to prevent binding on the saw. See that the fence B does not come beyond the points of the



Management of Circular Saw.

saw-teeth, as denoted by dotted lines, or binding of the timber on the saw may cause trouble. C indicates the piece of timber that is being sawn, D the saw, and E the bench. The teeth of the saw should be evenly set, and when cutting green timber the teeth should be more set than when cutting dry, hard timber. See that the gauge of the saw is suitable to the diameter, etc. A saw of too thin a gauge will be a dangerous tool, especially in the hands of a novice. Pack the saw so that the heat caused by the friction will equalise the tension in the saw-plate. The packing should be made by wrapping some clean hemp evenly around two strips of wood nutil they are thick enough to fill the space on each side of the fore half of the saw. See that there is no end play in the saw-spindle, that it fits nicely in the bearings, is perfectly level, and that the eye of the saw is not a tight fit on the spindle. The saw should be kept round by an occasional run down, and excessive lead or rake in the teeth should be avoided.

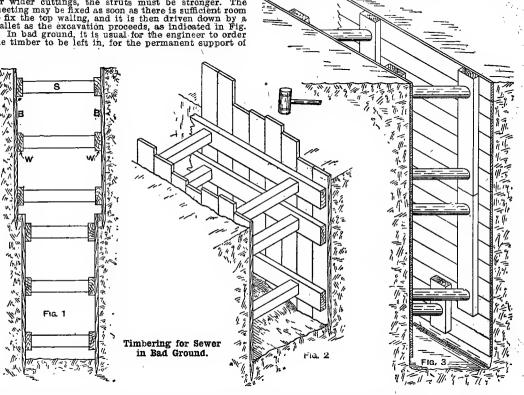
Lining Gig Collar.—When lining a gig collar, it is better to take the lining off and make it like new. But when it is a question of healing sore shoulders, though pads are often put near the sores to keep the collar away, the more commendable system is to chamber the collar opposite the sore, which can be done as follows: In the lining opposite the sore part make two cross slits, their lengths varying according to the extent of the sore. Then damp the leather well, and turn up the four points. With a knife scoop a hig hole in the straw underneath, taking it out to a good depth, and making the hollow slant towards the sides; but cut in farther than the leather can be turned up, so that there will be no sharp edge to the hollow to cause another sore. A small collar needle and a long thread with a little twist will be needed for stitching. Make some stitches from the outside of the collar to draw the leather lining down deep into the hollow; sittch round the edges, and also put several stitches in the centre. Some makers put flock under the stitches inside the hollow. The collar can also be patched up again when the sores are healed,

Repairing Trap or Carriage Harness.—When repairing trap or carriage harness of all kinds, such as reins, breeching straps, crupper billets, etc., shave the under side of the splice on the top and the top part underneath, making them as nearly as possible of the same thickness of a single strap. A splice must never be stitched across in a single strap, but always forward along the strap. When, however, only two rows are made in a splice, always put two or three stitches in the centre of the top lay of the splice at the point.

Timbering for Sewer in Bad Ground.—The accompanying illustration (Fig. 1) shows the excavation for a sewer taken down 12 ft. deep. In had ground the sheeting or boarding B is set close together to prevent small particles of earth finding their way through the interspaces, and it is often necessary, if the ground is very bad and wet, to place hay or other fibrous material behind the sheeting. The sheeting boards are usually 9 in. by 1½ in. The walings or runners w are usually 9 in. by 5 in.; and the struts s 5 in. by 5 in. square or 6 in. diameter circular, for cuttings of ordinary width; for wider cuttings, the struts must be stronger. The sheeting may be fixed as soon as there is sufficient room to fix the top waling, and it is then driven down by a mallet as the excavation proceeds, as indicated in Fig. 2. In bad ground, it is usual for the engineer to order the timber to be left in, for the permanent support of

hldes were simply immersed in the tan liquor and kept stationary, and four times as fast as when the hides were moved and no current was passed. In the process of Worms and Bale was used a barrel having a capacity of 12,000 litres, and containing a charge of 700 kilogrammes of hide and 5,000 litres of cak-bark extract; copper electrodes were attached to the inside of the barrel, and a current of 11.5 amperes at a pressure of 74 volts was employed. Tanning is complete in from 48 to 144 hours, but the leather suffers from the violent mechanical pounding. The old non-electrical methods of tanning take a long while, and include circulating the tan liquor so as constantly to bring fresh portions to the hide, forcing the liquid through the hide, and using strong aqueous extracts of tanning materials.

Artificial Indiarubber.—A French method for preparing artificial indiarubber uses ramie fibre, and, further, the milky juice of a Chinese plant known in England as Pontianak gum. The ramie fibre is dried, oily and



the sides of the trench. To this method, however, it has been objected that it would be necessary to excavate to the depth of 6 ft. hefore the poling boards could be put in, and that very bad soil would cave in before that depth was reached. If sheeting boards are used horizontally, as shown in Fig. 3, a board can be added at every foot excavated, and at once supported by short poling boards and struts. When five or six boards have been inserted, longer poling boards can be added, and some of the former struts dispensed with. An objection to this last described method—that of horizontal sheeting—is that the struts and poling boards have to be inserted and taken out again several times, and, in loose ground, there is the danger of losing a large fraction of an inch at each operation.

Tanning Hdes Electrically.—In Groth's process the tan liquor is contained in a tank in which is a frame carrying hides and capable of being moved to and fro, or rotated so as to bring the hide continuously into contact with fresh liquor. Copper electrodes are placed at the side of the tank, and for a 1,500-gal, vat a current of not more than 4 ampères is used, the current density not being more than \(\frac{1}{2} \) camper per square foot of transverse section of the vat. Even with this mild stimulus the rate of tanning is sixteen times as fast as when the

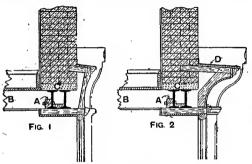
volatile matters are removed from it, and then it is mixed with the Pontianak gum, the mixture afterwards being crushed between cylinders heated to 50° C. (122° F.). Then the mass passes to an oven heated to 150° C. (302° F.), the temperature gradually being raised to a point between 175° C. and 205° C. (347° F. and 401° F.); at the end of four hours the mass is allowed to cool, and then it is seen that, whilst the fibrous structure remains, the textile resistance 1s destroyed completely. At a temperature of 50° C. (122° F.) the mixture-is worked in a mixing mill until the fibrous structure is destroyed and the mass is uniform. During this last working is introduced from 5 to 8 per cent, of oxygen-containing substandes, such as borate of manganese or permanganate of potassium, and, if desired, not more than 10 per cent of softening material such as balata gum, and perhaps a little sulphur. The proportions for a good flexible rubber are Pontianak gum, 80 per cent.; ramie fibre, 15 per cent.; and sulphur, 5 per cent. After the working in the mixing mill, the mass is allowed to cool for forty hours to permit of thorough assimilation, and then it is cooked for three hours by steam at a pressure of 50 lb. per square inch. The cool product is said to have all the properties of rubber, though, as a matter of fact, rubber substitutes have not yet proved satisfactory.

Determining Melting Point of Paraffin Wax.—
The melting point of paraffin wax varies with different samples. The highest grade, having a melting point of from 135° to 140° F., is used but rarely, and is made only for special purposes. The grades of paraffin wax are designated commercially by their melting points. Thus, there is "120° wax," "115° wax," '110° wax," and "100° wax," the last being very soft and not much used in candle-making. To determine the melting point, take a short length of glass tubing, #, in. in diameter, and draw it out slightly in a flame, breaking off the drawnout parts oo as to form a pipette. Melt some of the wax and dip into the drawn-out tube, in which, on removal, a small quantity of wax will remain. Allow this two or three hours to become quite cold, and then tie the tube to a thermometer with the end containing the wax against the hulh. Half fill a glass beaker with water, support the thermometer and tube in the water, and gently heat over a Bunsen or spirit lamp. Carefully watch, and when the wax loses its opaque appearance and runs up the tube owing to the pressure of water, the melting point of the wax may be said to occur.

Fixing Shon-front Fascias.—In hullding a new shop-

Fixing Shop-front Fascias.—In building a new shop-front, the fascia, if perpendicular to the sash, would run behind the truss to which it would be screwed. If, however, the fascia in question is to be fixed between existing trusses, a moulded fillet should be fixed at the angle required, the same moulding being carried along the top and bottom of the fascia to form a frame. The fascia is then screwed from the back. The cover board should be made to project 1 in. There are many different ways of making concave and convex circular-on-plan fascias. What will answer for a flat curve will not do for a sharp one. A fascia like that shown in Fig. 1

decided floral pattern, have the heads facing the light, or at least in the opposite direction to the doorway. In cutting off silow i in. each way for seaming, unless the carpet has a plain woven selvedge, when I in. should be allowed at each end only. Mark each length of carpet and horders with consecutive numbers, and mark the same on the floor so as to facilitate each portion being sewn in its proper position; this work is generally done by female labour, the carpet-seaming machines on the market being expensive. The carpet is seamed by lapjoins with strong carpet twist, and the edges and seams are bound with grey linen webbing. If the carpet has to be secured to the floor with rings which hook on brass-headed, drugget pins knocked in the floor, the rings are sewn to the webbing at intervals of 8 in. all round the carpet square. When the seaming, etc., is done, the carpet is ready for stretching and pressing. To do this a carpet stretcher (Fig. 2) and a heavy goose from is required. Place the carpet is a had fit to the chalk lines. Therefore stand on the carpet, and with the stretcher held in front, work one line square and straight to the chalk line, then pin it fast to the floor with drugget pins, and stretch in the opposite direction, always commencing in the centre and working to the ends. Foliow out the pinning down until the carpet lies square and straight with the chalk lines. Should any part be baggy or slack edged, it can he shrunk to shape by wringing out a cloth in cold water, placing this on the slack part, and ironing with the hot goose iron. All the seams should also be well pressed, and the carpet left overnight to set, when it must be well swept and the pins removed. Before the carpet is laid, examine the floor for projecting nail heads or knots in

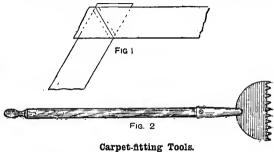


Shon-front Fascias.

could be prepared out of a solid piece of pine, but a fascia like that in Fig. 2 must be either prepared in cement (which, by the way, makes a very rough job) or built up with cradling brackets and a face lining, well blocked at the back. In the latter case the brackets should be prepared and shaped as required, the face lining being taken out of \$\frac{1}{2}\text{in}\$, good dry pine, well screwed to the brackets. A cylinder shaped the reverse way from that required would be helpful in getting the brackets to the proper shape. In the illustrations, the rolled-iron joists are 9 in. by 5 in., with a 4\frac{1}{2}\text{in}\$, by 5-in. fir flitch \$\frac{1}{2}\text{it}\$ to joists \$B\$ are 9 in. by 5 in.; c shows stone template. In Fig. 2, the top D can be finished off with 5-lb. lead flashing, copper nailed at front.

To Obtain Chlorine without Heat. - For this purpose act with dilute sulphuric acid on a mixture of 3 parts of common salt and 1 part of chlorate of soda or chlorate of potash.

Fitting Carpets.—The block plan of the carpet should first be laid in chalk lines on the floor, details of fireplaces, recesses, windows, etc., heing filled in afterwards. Add all the measurements and check them, as there is no chance of rectifying mistakes without wasting material after cutting is commenced. First cut the borders, the centre carpet heing filled in afterwards. The borders are mitred at each corner, the method of marking the mitres heing explained in Fig. 1; the centre line will be the join, and the dotted lines are the cutting lines, the overlay heing required for seaming. Pin the strips down, as cut, with a few drugget plus. Carpet borders are usually 1 ft. and 1 ft, 6 in. wide, and the cutting is done with a pair of stout 14-in. shears, a light wood T square and a pointed piece of chalk being required for marking off square. The carpet is now laid in the centre, and particular care must be taken to match the pattern accurately. If the carpet has a



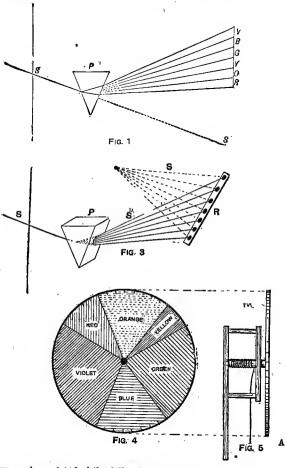
the wood; the former must be punched in, and the latter shaved off with a plane, a round iron being used to prevent digging at the corners. Felt underlays and surrounds are sewn together and cut to shape afterwards, any slack parts that may occur being damped out. Seams across the widths of the carpet are scratched out with a steel comb, and sewn together one on the other, the pattern being matched as accurately as possible. They are never used in first-class work. Stair and corridor carpets are never planned to fit, the method being to take the roll to the house and lay it in position, afterwards cutting and binding the ends with webbing. For winding stairs it will be necessary tocut out pointed pieces to get the carpet to sweep the curves. In doing this allow for turnings, and fray tha edges and seams on the wrong side. The seam must lie quite close to the joints of the treads and risers.

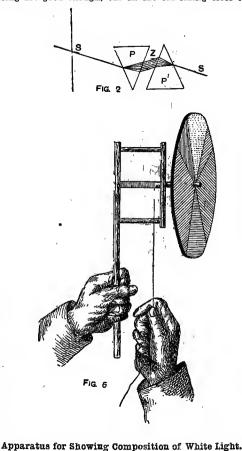
Manufacture of Optical Glass.— The process of making silicate glass is as follows: The crucible is well dried, gradually heated for four or five days until it is red hot, and then placed in the melting oven, where, the temperature having been raised, pieces of glass are placed in it so as to coat the inside of the crucible. The raw materials are then put in, and, having heen melted, are kept at a high temperature for six or eighthours. The glass is then stirred, and, after a portion has been tested by means of a tube and has been found freefrom bubbles and impurities, the crucible is lifted out and left in the open air for from thirty to forty-five minutes, so as to cool slightly, and is then placed in the oven that has been used for heating the next batch of glass. In this oven it cools for three days, during which time the glass breaks into many pieces, which are broken still smaller and placed in moulds, mostly in the form of slabs. On heating, the glass melts and takes the form of the mould, and at once the cooling process, lasting twelve days, begins. The cold slabs have their opposite sides polished, to see whether they are free from defects. Many lenses, prisms, etc., are cast in a similar manner.

Determining Composition of White Light.—White light as derived from the sun is the source of colour. It possesses the inherent property of giving to external objects different hues or shades when seen by the human eye, white light being a mixture of rays of different colours, any one of which acting alone on the retins of the eye would produce the colour of that particular ray, while the sensation of white is the blending of all rays. The composition of sunlight was investigated by Sir Isaac Newton in the following manner: Having closed the window shutter of a room so as to exclude all sunlight, he cut a hole sbout \(\frac{1}{2}\) in in diameter in the shutter, and admitted a beam or pencil of sunlight through the hole; at some distance from the window he placed a glass prism r (Fig. 1) so as to receive the pencil of light s, which was refracted by the two faces of the prism, and the light thus refracted was reflected on the opposite wall and produced the solar or prismatic spectrum. This spectrum was an elongated image of the

the following simple arrangement will suffice: Divide the circumference of a circular card (Fig. 4) into forty-eight equal parts, and draw lines from the circumference dividing the circle into six sectors, alloting five equal parts of the circumference to red, eight parts to orange, three to yellow, eleven to green, eight to blue, and thirteen to violet. Fix the card on a horizontal axis (Fig. 5), around which is wound a piece of cord; by pulling the cord quickly, the card is made to rotate rapidly, and the coloured rays proceeding from the card to the eye become so blended as to give to the card the appearance of whiteness. A pure white is not produced simply because the colours on the card are not as pure as those in the prismatic spectrum. Fig. 6 shows the method of rotating the card.

Relining and Stuffing Saddle Panels.—For this, begin work by removing the panel, and, if the back and facing are good enough, cut off the old lining close to





sun, and consisted of the following colours: red, orange, yellow, green, blue, and violet. Newton found that sunlight was not homogeneous, but consisted of rays of different refrangibility. No one sort of these rays is capable of producing whiteness, which is a compound of all the primary colours in their proper proportion. To prove the recomposition of white light, Newton received the refracted pencil of rays 2 (Fig. 2) on a second prism P' held either against the prism P or at a little distance behind it, and by the opposite refraction of this prism the coloured rays were all refracted back into a beam s' of perfectly white light. Another experiment of Newton in proof of his doctrine of the composition of white light was to cause the coloured rays s' (Fig. 3) of the solar spectrum to fall severally on a concave reflector R fixed at some distance from the prism P, and then by adjusting the reflector to converge all the coloured rays s' into a spot S, and mix them again as they were in the pencil of light hefore its incidence on the prism. Or, instead of the prism or other apparatus,

the stitches running by the side of the facing, but let part of the lining and stitches be there to keep the facing in place. Cut the new lining as for a new panel, and tack it with hemp, turning in the edges and spot-stitching it down by the facing along both sides. On the outside, the stitch must be small and neat. Stitch the lining in at the top slong the old marks, and whip it in at the bottom. It is stuffed like a new panel, and for a good saddle is quitied and adjusted with wire, or apotted and stitched all along; for a common saddle, five or six stitches together here and there will suffice. When the back is good and the facing bad, stitch on a new facing with new cord, and stitch the lining like a new one.

Brown Wax for Saddlers.—For this use beeswax, 1 lb.; pale resin, 3 oz.; and white-lead, 3 oz. The wax can be softened or hardened by adding more or less beeswax. Melt the mixture, stirring it, then pour it into water and pull until it floats.

Imitation Tree Trunk for Photographie Studio.—A tree trunk as a photographer's accessory can he made in rough gesso work. The shell would be made of thin laths bradded round supports of thicker board cut to half-round shape. This frame would he sized over to give the gesso a firm hold. Gesso is glue water thickened with plaster-of-Paris, whiting, or chalk. A ready mixed composition is sold by artists' colourmen, but this might be too expensive for so large a work. Ten ounces of glue dissolved in 2½ pt. of water has heen recommended; and to this some workers add small quantities of linseed oil, pitch, and resin. Into the hot glue water the plaster is stirred till it is as thick as cream; it can then he huilt, whilst hot, upon the sized wood with a spatula, and modelled to the roughness of the hark, etc., with a stiff brush. Only a little at a time should be mixed, as it soon sets. Large prominences, as knots, etc. may be built up with rough putty, and worked over with gesso when set. Some workers gain relief by dipping cotton-wool in the composition and modelling it on the work. When it has set and has been sized over the gesso forms an excellent surface for painting upon. Rocks, etc., might be formed in the same way. Imitation Tree Trunk for Photographic Studio. same wav

Dark-room Ventilator.—The accompanying illustra-tions show the construction of a metal ventilator for a portable dark room. Fig. 1 shows the various parts,

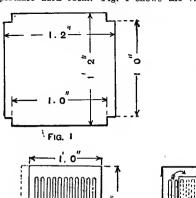


Fig. 2 Dark-room Ventilator.

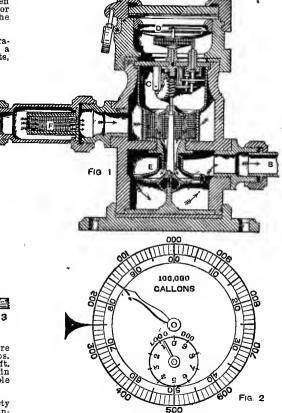
and Fig. 2 is one of the sides. When the four sides are and rig. 2 is one of the sittes. When the four sittes are bent into shape the dotted part, I in. wide, overlaps. The centre hole is made from a rectangular piece, I ft. 8 in. long by 8 in. wide. Fig. 3 shows the ventilator in position, with a sheet of perforated zinc across the hole in the dark-room ceiling.

Removing Old Veneer.—Make a ring or wall of putty around the piece to be removed. Then heat some linseed oil in a water bath until the water boils. Pour the oil over the veneer and allow to remain for about three hours. By that time the oil should have soaked through the veneer and softened the glue. Then carefully insert under the veneer a wide, thin chisel, keeping it wet in hot water.

Cleaning Blue Leather Cushions of Landau.—
For cleaning and reviving the blue leather cushions of a landau, first well wash the leather with a warm solution of common soda, and, before it is quite dry, make a solution of blue aniline dye (procure a penny packet and dissolve as directed), and put in it whilst hot a little isinglass. While the solution is still warm, well rub it into the leather with a clean, soft rag till a eatisfactory polish is obtained. One or more coats of the solution can be given, finishing off hy rubbing after the application of each coat till the leather is of the required shade. The blue shade can also he regulated by the use of more or less hot water.

Siemens's Water Meter,—The working of this meter depends upon what is known as the "Barker's Mill" action, which may be compared to that of the firework known as pin-wheel or Catherine wheel. The water, after passing through a gauze filter, is conducted into

the centre of the pivoted drum shown near the bottom of the meter in Fig. 1. Around the edge of this drum are three or four apertures arranged so that the water escapes tangentially; that is to say, it does not flow straight out from the centre, but at an angle sideways, and this causes the drum to revolve in the opposite direction to the escaping streams of water. The more the water that passes through, the greater the number of the revolutions of the drum, so that it is only necessary to register the number of revolutions in order to ascertain the quantity of water passed; this registration is effected by the counting gear, and the result is indicated on the dial at the top of the meter. Fig. 2 shows the dial as affixed to the smaller sizes of metre, the larger ones being very similar. The dial itself revolves, as well as the hands on the inner circles. The outside circle represents 1,000 gal. for a complete revolution, divided into 100 parts of 10 gal. each. The reading of



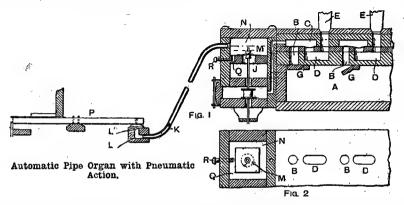
Siemens's Water Meter.

this circle is taken from the black arrowhead outside the circle, but, as a rule, the reading is only taken for experimental purposes, or to ascertain whether the meter is working. The large inner circle represents 100,000 gal. each revolution, divided into 100 parts of 1,000 gal. each. The small circle at the bottom of the dial represents 1,000,000 gal. for a complete revolution, divided into 10 parts of 100,000 gal. The reading of the dial as shown would then be, for the small circle, something less than 100,000, and by inspection it can be seen that it somewhere near 80,000 or 90,000; from the larger inner circle the reading is 85,000, and to this must be added 250 gal. from the outside circle. The meter should be fixed perfectly level, and placed where it will be accessible for reading. If possible, it should be governed by a loose-valve stopcock or sluice valve, and must be protected from frost by packing with sawdust, felt, or stable litter. Meters fixed in connection with pumps should have an air-vessel between the meter and the pump, so as to avoid concussion caused by the pulsations. In Fig. 1, A signifies inlet; B, ontiet; C, counting gear; D, dial; E, revolving drum; F, filter.

Repairing Damaged Couch Seats.—To repair a ripped or torn velvet covering of a couch seat remove the cover either from part or the whole of the seat, and well cross-etitch the rip with fine coloured twist. The stitches will bury themselves in the pile and will not be noticed. Then further strengthen the cover with a stout piece of Forfar large enough to cover the rip and allow about lin. over; this must be slip stitched to the un er side of the cover. The work must be well done, otherwise the preseure of the springs will soon make the stitching gape. A more satisfactory job is to have either a new half cover or a whole cover for the seat. In the former case, a welted seam would have to be made across the centre of the couch seat.

Automatic Pipe Organ with Pneumatic Action.—
Fig. 1 shows the application of an automatic device with a pneumatic action to a pipe organ. It is the tracker, and L the aperture, which can he covered with the key or, by a slight change, with a paper music sheet. The tube K communicates with a cheat N in this case, containing wind at bellows pressure. When the key Pis raised from L, wind is allowed to escape, permitting the diaphragm valve M to rise. This allows wind to escape from C through the opening J. The leather valve covering B and D is not held down, but wind can pass from the main wind-cheat A through the holes B and D to the pipes E if the stop valve G is open. In the specification, stress is laid upon the equalising port Q regulated by the screw B, which can be adjusted easily from the outside.

lies evenly, and pass the hand over it so as to make it "stick" or adhere properly. Care must be taken not to injure or displace the sewing during the above operation. The end papers are now put on and the back is glued, and the cords are pasted and stuck down on the end papers. Care must be taken not to use too much paste so as to unduly damp the end papers. When all is dry, the edges are cut and the rounding and backing are proceeded with as usual. The back is afterwirds lined with a piece of mull or buckram. This lining is cut a trifle shorter than the book and quite lin. broader than the thickness of the book. The book is put into the lying press with the back upwards above the cheeks of the press. The back is glued and the lining put on so as to have \(\frac{1}{2} \) in. hanging over on the sides. The lining should be drawn on to the back tightly and rubbed down with the folder. Over this lining another lining of paper is glued. The paper is cut exactly the breadth of the back and a little longer. The back is again glued and the paper lining put on evenly and well rubbed down. The book is now removed from the press, and the paper lining trimmed with the scissors close to the edges at the ends. The hook is now put into the case. The back of the case having been made round by pulling it over the edge of a backing board, lay it open on the bench and place the book in position, taking care that the top of the bock and case coincide. Adjust the book carefully upon the board lying on the bench, and close the other board over the book. Having made sure that everything fits



It is claimed that by a suitable arrangement of the valves exhaust wind can be used for the motor and valves. Fig. 2 is a plan of the wind chest and section of the chamber N, one such chamber being provided for each key of the manual or aperture of the tracker.

Ink for Marking Flannels.—A violet ink for stamping purposes may be made by dissolving \(\frac{1}{2} \) cz. of aniline blue or violet in \(\frac{1}{2} \) or water, and mixing with \(\frac{1}{2} \) oz. of glycerine. If this ink should rub off too easily, dissolve \(\frac{1}{2} \) cz. of gelatine in the water. Apply the ink to a pad of felt stretched on a block of wood, and press the stamp on it. A violet-black ink may be made by replacing the voilet with nigrosin or water soluble black. These inks are best applied with a rubber stamp, but flannels can be more easily marked with a stencil. The inks are washed out easily.

Binding Books in Publisher's Cases.—In binding books in the publisher's cases the cords are not fastened to the boards but to the book itself. The usual method of doing this work is as follows:—After the book has been sewn in the usual manner, it is laid down on the forwarding bench and the cords are craped—that is, the ends of the cords which have been left by the sewer. These cords are first opened out by twisting backwards, and then scraped with a knife assisted by the fingers, the object being to get the cord into single threads, and when finished each cord will look like a little brush or bunch of bristles. After scraping, the cords should be cut squarely along the ends, which should be about \(\frac{1}{2}\) in long. The first and last section of the book should now be pasted. To do this, the book must lie on the bench with the back towards the right hand. Open the top section and allow it to fall downwards on the bench; this will completely expose the second section. Now place on the book avaing a straight edge, and with the finger paste the expose at the exposed attip of the second section. This will rive a strip of paste \(\frac{1}{2}\) in the first section on this, taking care that it

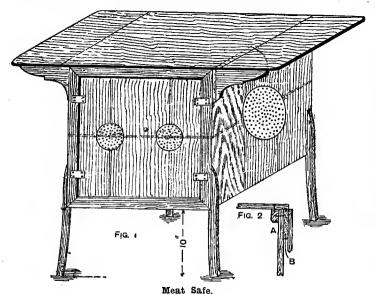
properly, place the book again on the bench with the back towards the left hand, open the top board, and glue the end paper. During this operation take care to lift the piece of lining and glue underneath, and push it well into the joint and glue over it. Now shut down the board and turn over the book, repeating the operation, and finally put the book into the press and leave until dry.

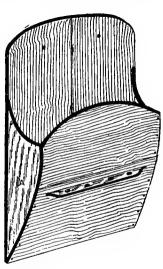
Removing Soft Solder from Gold.—If the gold is of common quality, under 12-carat, to remove the solder make a mixture by reducing to powder 10z. of green copperas and ½ cz. of saltpetre and holling in 50z, of water. This will crystallise when cool. Redissolve the crystals in eight times their bulk of muriatic acid. For use, add boiling water, and place the gold in the hot mixture. For gold of 12-carat or over, nitric acid and water (1 part of acid to 2 of water) will dissolve the solder without injuring the gold.

Blackening Opera Glasses.—For the interiors, get a little vegetable black and put it into a pot. Make it into a stiff paste with a little gold lacquer. Mix the paste with a palette knife and press out all lumps. Now thin it down with methylated spirit so that it will run through fine muslin. This gives a dull black which requires little heat to put on and does not rub off. To blacken the exterior parts, pour into an earthenware pot \(\frac{1}{2} \) lb of nitric acid, and stand it in an open space so that the fumes may easily get away. Now add \(\frac{1}{2} \) co foopper wire, and let the acid eat it all away. Be careful not to breathe any of the fumes. When boiling has stopped, add \(\frac{1}{2} \) oz. of water. The preparation is now ready for use. To bronze the parts, first heat them separately over a spirit lamp or Bungen burner, and immerse them in the nitric bath. When dipped they should just hiss. Take them out, draining back as much of the fluid as possible, and burn off over the Bunsen all the green till it goes black. When cold, with a brush and a little powdered blacklead, brush off all the corrosive. The metal will now be a beautiful black with a fine granulated surface.

on a plece of porcelain until they fuse, and three-fourths of the silver wire rolled in the fused chloride of silver until thickly coated with it. Some of the remaining curds may next be spread as a paste on strips of thick blotting paper and rolled round the coated silver wire, then bound thereto by several turns of soft cotton. This porous paper will then serve the purpose of a porous cell. The upper fourth of the kinc cylinder should be coated with asphalt varnish to prevent chemical action on this part. The cylinder is then put into the containing tube, the swaddled silver wirs is placed centrally in the zinc cylinder, and the space filled with a solution of caustic soda. The cells, thus prepared and charged, must be packed in an upright position in a wooden box with paper or sawdust between them, and connected in series by attaching the zinc of one cell to the silver wire of the next, and so on throughout the whole number. The current will be taken off from the silver wire at one end of the series, connection being made to the zinc cylinder at the other end. The smallest Leclanche cells used for ringing electric bells may also be employed.

Combined Newspaper Rack and Pipe Rack.—The accompanying figure illustrates a useful newspaper and pipe rack. It may be home-made, the construction being simple, as rebating, etc., is not necessary. If made of





Newspaper and Pipe Rack.

pieces is fitted in the middle, and rests on a batten $\frac{3}{4}$ in. square which covers the zinc and is screwed from the outside. The legs are 1 ft. 4 in. long, and have a $\frac{1}{4}$ -in. shoulder 10 in from the floor on which the bottom of the safe lodges. They are $\frac{1}{4}$ in. square, and are secured with 2-in. brass screws. The outside, with the exception of the top, may be stained or grained, b t the inside is sweeter if left from the plane and washed out regularly.

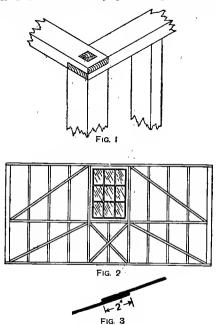
Rectric Battery for Medical Treatment.—For an electric battery to furnish a continuous current for the treatment of sciatica and similar ailments, a large number of cells will be required, arranged in series to provide sufficient electro-motive force to overcome the high resistance of the human body. These cells may be small (no larger than large test tubes), so that many of them may be packed in a small compass. As the number required will depend on the desired strength of current necessary to effect a cure, the medical attendant must determine the number of cells. The chloride of silver cells will be the best. Each of these cells may be constructed as follows:—Procure some sheet zinc, cut off a strip wide enough to make a small cylinder fitting ths containing tubs, and long enough to match the length of tube, with about 1 in. over to form a connecting tang. Also procure some No. 18 gauge silver wire, and cut from it a piece 1 in. longer than the tubs. Dissolve some scrap silver in dilute nitric acid, or get some nitrate of silver and dissolve it in distilled water; then add brine to this until it ceases to throw down white curds. These curds are chloride of silver, and must be separated from the brine by pouring all the liquid portion away. Some of these curds must then be carefully dried, then beated

teak or mahogany, it will be rich-looking. The leading dimensions, which could be modified to fit a corner or for any other reason, are as follows. Extrems length and width of back are lft. 8 in. and lft. 1 in. respectively by \(\frac{1}{2}\) in thick. The sides A are \(\frac{1}{2}\) in thick, and are secured to the back with \(\frac{1}{2}\) in. hrass screws from the back. The back edges of the sides are \(\frac{1}{2}\) ft. long, the front edges being \(\frac{1}{2}\) ft. long, and the width at the widest place, which is \(\frac{1}{2}\) ft. from the bottom, is \(\frac{5}{2}\) in. The front is \(\frac{1}{2}\) ft. from the bottom, is \(\frac{5}{2}\) in. The front is \(\frac{1}{2}\) ft. stuff in two pieces, and is secured with brass rivets to the sides. The pipe rack is \(\frac{1}{2}\) ft. long, \(\frac{1}{2}\) in. wide, and \(\frac{1}{2}\) in. thick; it is secured to the front by two screws from the inside before it is nailed on. The whole may be either polished or varnished.

Paint on Cement Blistering and Peeling.—Blistered paint on cement is caused by free alkali in the cement attacking the paint; this state of things is often noticed in new work. Paint on plaster peels because the paint is not sufficiently fluid. The first coat on new plaster should be very thin in order that the paint may penetrate the plaster and harden its surface so as to make a key for the following coat of paint. Abundance of time should also be allowed between each coat. When painting new plaster or cement work, the best results will be obtained by first coating the surface with petrifying liquid, and afterwards applying one or more coats of washable distemper paint coloured with lime-resisting colours. This paint is much easier to apply than oil paints and will not peel or blister. The work may then, after a reasonable period (about twelve months), be finished or treated with oil paints without any risk of peeling, etc.

Painting Bottoms of Model Yachts.—The bottoms of model yachts may be primed in the ordinary way with a preservative coat of white-lead paint, flatted or smoothed with No. 0 sandpaper, and then given two coats of copper bronze paint made by mixing copper bronze powder with heavy or thick celluloid varnish, following with a coat of finest carriage or body varnish, which should be applied warm to ensure a perfectly smooth and even finish.

Portable Houses.—Portable buildings are constructed preferably on a brick foundation with a damp-proof course under the ground-floor wall plate. All joists should rest on plates instead of directly on walls, whether main, cross, or sleeper walls. The corner posts are usually square in order to align, or line, with the others both ways, and also for the purpose of strengthening the angles. There are various methods of framing the corner posts into the heads and sills; one way is to halve the horizontal pieces together, and stump tenon the vertical through the horizontal pieces as shown in Fig. 1. The intermediate uprights are spaced according

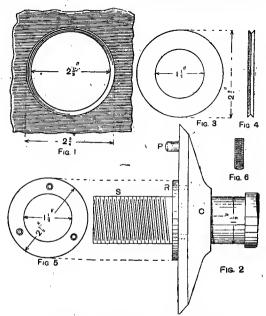


Portable Houses,

to circumstances from 18 in. to 3ft. apart, depending partly on the quality of the work and partly on the spacing of the doors and windows. When the uprights are at the side of window or door openings, the uprights must be tenoned into head and sill; the other uprights are usually nailed only. An economical plan is to put closed-spaced uprights below the lowest row of stretchers, and wider-spaced uprights above. A row of stretchers, and wider-spaced uprights above. A row of stretchers 4in. by 2 in., or horizontal intermediate timbers, should be placed immediately below the level of the window sills all round, and another row may be placed midway between the sill and the head piece, but this row is often omitted as the upper bracing is considered sufficient. The bracing is an essential part of the structure, and may be arranged in various ways, as, for example, in the manner shown in Fig. 2. The door openings are formed by the posts framed in between the head and the sill, and fillets nailed on for the door to shut against, or sometimes a headed jamb lining with fillets is used. Felting and filling with sawdust may be used in order to deaden the sound through the partitions, but many hotels in Norway are built of fimber without any sound-proofing. The principal rafters will rest ou the top plate, the feet being held in by nailing the ceiling joists to the sides. With 4in. by 2in. purlins 4ft. to 4ft. 6in. apart, the principal rafters, 6in. hy 2in., may he from 4ft. to 5ft. apart for a span of 12ft. If the roof is hipped, hip rafters must be used, but the cheaper and easier plan is to make gable ends. The purlins in a hipped roof are generally splayed to it and nailed to a hip rafter, the tops being level when no common rafters are used. The corrugated sheets 10ft. long, 1ft. overhanging, should

have three rows of support, namely, the ridge, a centre purlin, and the pole plate or lower purlin. When the brick foundation is wide enough, the joists may rest on a plate on the inner edge, but otherwise the joists will rest on the bottom sill of the framing. Galvanised sheets, according to their substance, may be cut with shears or a chisel. The walls must all be boarded inside, but whether canvas or paper is hung will depend on circumstances. The better plan generally is to line with varnished matchboarding. An earth-closet should not be directly attached to the main building. A separate structure, with a covered way between, open on both sides, is generally provided. The outside weatherboards should have a lap of 1 in. to 1½ in. If sarking felt is used under the iron roofing, the felt should have, say, 2 in. lap, as shown in Fig. 3. If the walls are felted and the felt is butted over the uprights, no lap is necessary.

Fitting Circular Saw on Small Spindle.—Below is described how to fit a circular saw with a 2½-in. hole on a 1½-in. spindle. The hole may be reduced to 1½ in. by ringing up the 2½-in. hole. Fig. 1 shows a 2½-in. hole filed to a hevel for a depth of about ½ in., thus making an outer circle 2½ in. in diameter. This bevelling should be



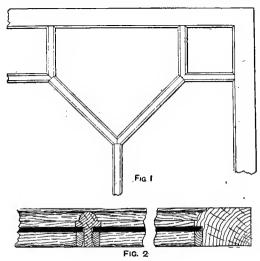
Fitting Circular Saw on Small Spindle.

done on both sides of the hole. A ring, such as is illustrated in Fig. 3, equal in thickness to the saw-plate, is secured in the vice, and with an angular file a groove is filed around the edge of the ring, as in Fig. 4. The saw is now placed on an anvil or on a flat piece of irou, and the ring slowly forced into the 2½-in. hole with a hammer, care being taken not to hammer the saw-plate. The ring is now hammered down on the hevel made in the 2½-in. hole. Any inequality in the ring may be filed down with a topping file, placed flat across the ring. Another method is to bore three holes in a ring 1½ in. in diameter, as Fig. 5. These holes are countersunk. Bore and tap three corresponding holes in the collar on the saw-spindle for a depth of ½ in. or ¾ in.; into these holes are secured three little studs, as Fig. 6. The holes in the ring are now passed down over the studs, and the heads of the studs are riveted into the countersunk holes and flee down fair with the face of the ring. In Fig. 2, C is the collar with the ring R secured to it; P is the steadypin; and 8 the end of the saw-spindle.

Block of Lead for Pinking Cloth.—Any lead merchant can supply a block of lead for use in pinking cloth, or the block can be cast by melting the lead in a plumber's solder-pot and pouring it into a sand mould. The top edge of the block should be made perfectly smooth, and this can be done by a carpenter's ordinary jack plane well greased on the face. The lead should not be less than I in. thick; thin blocks curl up at the sides when punching the silk. A sheet of white paper with a hard surface should be laid between the silk and the lead to prevent the former being soiled.

Permanganate of Potash.—This is prepared by beating to redness for several hours in a dish, a mixture of caustic potash and manganese dioxide, otherwise known as black exide of manganese. The fused mass has a brilliant green colour; it is dissolved in water, and treated with the requisite quantity of sulphuric soid to convert it into permanganate; the solution is then avaporated, and the sulphate of potash separated by crystallisation. The solution is then further concentrated, and the permanganate crystallies from it in blackish-red needles. Permanganate of potash is used principally as a disinfectant owing to the fact that it will give off oxygen on contact with putrefying organic matter and thus destroy the putrefaction.

Framing Bar in Sash.—In making a joint in a bookcase door at a point where three bara meet at an angle (see Fig. 1) a cabinet maker would probably form the bar in two parts, and so save labour in rebating. The stronger method is to prepare the bar in the manner shown in Fig. 2. Set out the sash and the bars full size on a rod, and cut the bars to the setting out: the ends framed to the stiles, etc., must be tenoned in. At the intersection of the bars the joints are cut so that the monldings intersect properly. When fitted, a saw cut is made close up to the rebate in each piece, and a veneer



Framing Bar in Sash,

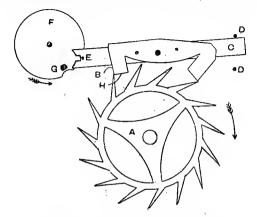
placed in the cut. When gluing up this forms a key, and makes a very strong job. A piece of thin tape or ribbon glued in the rebate gives additional strength.

Removing Varnish from Carvings.—Frequent applications of the varnish solvents, methylated spirit, wood naphtha, or liquid ammonia, will readily aciten apirit varnish or French poliah. As the varnish softens, scrab well with a nailbrush, and use pumice-stone powder in order to assist in gaining a clean surface. If oil varnish has been used, a mixture of liquid ammonia, spirit, and turpentine (equal parts of each) may be employed. This preparation has greater penetrating power than the former, and acts more quickly if used hot. The vessel containing the mixture must not be heated in contact with naked flame, but may be safely heated in a jar in an oven.

Lead Cylinder.—For making, by the process of lead burning, a closed lead cylinder 3ft. long and 2ft. in diameter, the lead should be cut out 3ft. 3in. long by 6ft. 3! in. wide. The 3-ft. 3-in. edges should be planed quite straight, and shaved \(\frac{1}{2}\) in. wide on one face for the seam. The lead is to be then folded in the form of a cylinder, the edges should butt together, and the shaved edges must be outside. Place a mandril, or a board edgeways, under the join, and burn up the seam with a hydrogen and atmospheric air flame. After the straight seam has been made, ascertain whether the cylinder has the same diameter in all parts; then boss the edges of the two ends inwards for about 1\(\frac{1}{2}\) in., and shave these edges \(\frac{1}{2}\) in. to 1in. wide Two discs of lead 1ft 10in. in diameter are then to be cut out, and the edges shaved \(\frac{1}{2}\) in. wide on both faces. The discs should then be placed in position on the ends of the body, and the seams burned all round. If the lead cylinder is to stand on one end, and a pressure will be exerted inside

the cylinder, the top disc should be domed in order to strengthen it. No flux of any kind is necessary. Lead, not solder, should be melted into the seams in order to strengthen them.

Action of Lever Watch Escapement.—The figure shows a lever escapement. The 'scape wheel A has fifteen teeth, and goes round in the direction shown by the arrow; one tooth is shown resting on the locking face B of one pallet. In this position the 'scape wheel cannot move. The lever 0 is also motionless, reating against oue of the banking pine B. If accidentally shaken while in this position, the guard pin B in the lever would come in contact with the edge of the roller F, and the lever could not move sufficiently to allow the 'scape wheel to go forward. This is the position the lever assumes between each heat of the watch. The balance and roller, in returning under the influence of the hairspring in the direction of the arrow, will cause the ruby pin G to enter the lever notch and carry the lever across. In so doing, as soon as the lever has been carried a little way, the 'scape-wheel tooth is unlocked and goes forward across the impulse face H of the pallet. The motion of the lever is thus accelerated, and an impulse is delivered to the ruby pin and balance. This continues until the tooth drops off the pallet face and another tooth falls upon the locking face of the other pallet. The lever will then rest against the other hanking pin,



Action of Lever Watch Escapement.

and the guard pin E will be on the other side of the roller F, having passed by means of the "passing hollow" in the roller opposite the ruby pin. The balance, on returning, carries the lever again, the 'scape wheel is released, delivers impulse, and is locked again as in the figure. The balance is quite free except when unlocking the wheel and receiving an impulse.

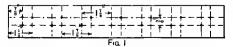
Govering Property of Paint.—The exact quantity, by weight, of paint required properly to cover a given aurface is not easily estimated, much depending on the volume of the paint, its quality, and its staining properties, and also the manner in which the unpainted surface was prepared before the paint was applied. Plaster and wood, owing to their absorbent nature, require considerably more paint than ironwork; woods with fine or close grain, like oak, are less absorbent than deal or white wood. The table given below abows the covering properties of various pigments in average circumstances:—

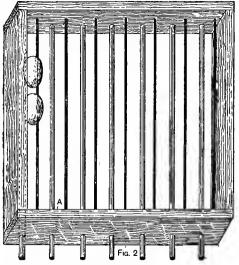
| atances:- | ETAL WO | DIZ | | |
|--|-----------|------|---|--|
| 1 lb. white paint will co- 1 lb. red oxide will cover 1 lb. zinc white will cov | ver | | First Coat. sq. yd. 7\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ | Second Coat. sq. yd. 9 12 14 |
| · W | OOD WO | RK. | First Coat. | Second Coat. sq. yd. |
| 1 lb. red oxide will cove 1 lh. zinc white will cove 1 lb. green paint will co 1 lb. boiled oil will cove | er ver | | 5 4 3½ 4½ | 6 5 4½ 6 |
| On placton 1 lb of ray | v oil wii | l co | ver 5 8q. | ft. for first |

On plaster 1 lb. of raw oil will cover 5 sq. ft. for first coat and 9 sq. ft. for second coat; 1 lb. of white-lead paint will cover 9 sq. it. for the first coat. These figures are based on paints mixed to working consistency with raw and boiled oils and from good quality paints, and it must be repeated that much depends on quality.

Brown Cream for Boots.—For a brown cream procure 4lb. of beeswax, 1lb. of pearlash, 2lb. of best yellow soap, 8lb. of turpentine, 1lb. of methylated spirit, and enough water to make the mixture of the required consistence. Put the pearlash into the water, and set it ou the fire to boil (if more water is necessary, it may be added afterwards), and scrape into it the wax and soap. Allow the mixture to boil till all is dissolved, stir well till homogeneous, and allow to cool down somewhat; then mix iu the turpentine, and lastly the spirit. Well mix all by stirring. If necessary, add water. For use, rub the cream on the leather, dry polish with a soft brush, and then with a linen rag.

Egg Turner for Incubator.—The egg turner here illustrated is made of a deal frame 2 in, by $\frac{1}{2}$ in to fit the egg drawer of an incubator. Before putting the frame together, screw the back and front together, and mark them off as Fig. 1. Now with a $\frac{1}{10}$ -in twist-bit make a hole through both pieces for the reliers; then with a $\frac{1}{10}$ -in. twist-bit before the egg rests. By drilling both pieces at one time, the





Egg Turner for Incubator.

rollers must be straight and will work without jerking. The rollers are made of \$\frac{1}{2}\$-in. reds, and are known as blind or garden sticks; they are obtainable at any iron-monger's. Also, \$\frac{1}{2}\$-in. knobs are put on the projecting ends of the reds, and can be procured from any wood-turner. After glueing the knobs on the ends of the rellers and passing the latter through the frame, iron washers are put inside the side A (Fig. 2), and a screw or pin is put through just inside the frame so that the rollers cannot pull out. Stair rods, being covered with brass, will be very satisfactory for the top row of egg rests. Fig. 2 shows the turner in working order.

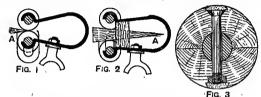
Neostyle or Cyclostyle Ink.—Neostyle ink used in duplicating apparatus is different in composition from printer's ink; the former contains glycerine, and the latter an exidised linseed oil. It would not be possible to convert the one into the other. An ink similar to neostyle ink may be made by grinding a little aniline violet with glycerine; should this prove too thick, thin down with a little spirit. The smell may be disguised by the addition of two or three drops of oil of cloves.

Preparing Casks to Hold Alcoholic Spirits.—The staves of oak casks and vats which are intended to hold gin and other clear alcoholic liquers are beiled (previous to being built into shaps) in a strong solution of alum and water to prevent their celcuring the spirit. All new oak casks, etc., are also lishle to taint their contents (more especially when the liquid contains a percentage of alcohol), and should therefore always be subjected to preliminary treatment. It is generally sufficient to fill the casks with water, to which is added

Ilb. of common salt, \(\frac{1}{2}\) lb. of washing soda, and \(\frac{1}{2}\) lb. of alum for every 18 gsl. of contents. Allow this to remain for a few days, then refill with pure water and let stand for a few hours, and finally scald or steam out the inside.

Silicates of Soda and Potash.—These resemble ordinary glass in composition, but they do not contain silicate of lime or slumins, and are soluble in water; hence the names given to them of soda water glass and potash water glass. These materials are formed by fusing a mixture of carbonate of sods or petash and sand or ground flint. The fused mixture is then heated with water. Silicate of soda is usually in the form of a colourless syrupy liquid, somewhat like treacle; it is very alkaline, and easily dissolves in water.

Fitting Wooden Roller to Small Wringer.—When one of two rubber-covered rollers is very much worn, it can be replaced with a wooden roller. With the wringer secured to the tub, two wedges are made about 1½ in. wide, in. long, and 1 in. thick at the head, and tapered to a point as at A (Figs. 1 and 2). Next, the handle is turned as for wringing until the check rings at the end will not permit further opening; see Fig. 2. Theu two chocks are fitted between the springs, and the hundle is turned the reverse way; this releases the wedges, and allows the rollers to be taken out, when, the old rubber being removed, four ½-iu. holes are drilled through the spindle. Next two pieces of 1-in. teak, 2in. wide and 14 in. long, are obtained, and a hellow to fit the spindle is worked out of each. Then placing one piece in position and holding it there with a small clamp, a bit is passed through the holes in the spindle snd he holes are bored in the first half. Before the cramp is removed punches are placed in two of the holes, the



Fitting Wooden Roller to Small Wringer.

cramp is removed, and the other half placed in position. Then the two parts being held together with the cramp, the two holes that are clear are bored through. The fastenings used are four finitial iron serews, with square nuts (see Fig. 3) let in in. below the surface, while the head is countersunk the same distance down. The pieces being secured with two of the screws, the punches are removed and the wood is bored through for the other two fastenings. All the bearing surface and iron spindle are well covered with white- or redlead, and the heads and nuts filled up with plaster-of-Paris. Next the blocks are squared up, taken off the spindle, cut 8 and 16-sided square, and rounded up with a hollow plane. The roller is then replaced in the springs, the wedges strained, and the chocks removed.

Indiarubber in Artificial Feet.—Indisrubber may be employed in the manufacture of various artificial limbs, but is not rigid enough to he used alone as a foot, even when moulded to the shape of one and cured; but it may be used as a sole to a foot made of willow, and would then soften the tread. The mixed sheet of softened rubber may be purchased and moulded like putty, and in this state made to stick to the wood, then cured. French chalk is used to prevent the plastic sticky rubber from adhering where it is not wanted; as, for instance, to a bandage wound over the sole to bind it in whilst being cured. A small stove can be used for curing small articles. But there are no artificial limbs so useful and durable as those made of willow and leather, with spiral steel springs to give elasticity to the step and so ten the tread.

Stephens' Blue-black Ink.—The universally knewn Stephens' blue-black ink is said to be made from galls 15 parts, sulphate of iron 5 parts, iron filings 4 parts, water 200 parts, indigo 4 part, and sulphuric acid 3 parts. The powdered galls should be beiled in the greater part of the water, and then filtered, the sulphate of iron should be dissolved in the remaining water, while the indigo should be dissolved in the sulphuric acid (which should be concentrated). The indige solution should then be added to the sulphate of iron solution, and the iron filings added to neutralise the excess of acid. After a few days the sulphate of iron solution should be decanted and added to the solution of the galls; the ink will then be complete.

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